

I 29.2:V 94/2

draft trail plan and environmental assessment

PUBLIC DOCUMENTS  
DEPOSITORY ITEM


NOV 29 1988

CLEMSON  
LIBRARY

# VOYAGEURS

NATIONAL PARK / MINNESOTA





Digitized by the Internet Archive  
in 2012 with funding from  
LYRASIS Members and Sloan Foundation

<http://archive.org/details/drafttrailplanen00nati>

# DRAFT TRAIL PLAN AND ENVIRONMENTAL ASSESSMENT

**voyageurs**  
NATIONAL PARK  
Minnesota

U.S. Department of the Interior/National Park Service



## SUMMARY

This Draft Trail Plan and Environmental Assessment for Voyageurs National Park presents four alternatives for winter trail systems and three alternatives for summer trail systems. These alternatives are essentially the same as those presented in the Trail Plan Alternatives workbook in May 1986. However, a no-action alternative (existing conditions) has been described for winter trail use to serve as a base for comparing the other alternatives, and changes have been made in the alignments of some trails as a result of analyzing environmental impacts. This plan deals only with trail use on the land areas of the park. Summer water-based travel and winter travel on major lakes will be addressed separately in other plans for the park.

## WINTER TRAIL ALTERNATIVES

Under all winter alternatives snowmobiling would continue to be allowed on the frozen surfaces of the major lakes--Rainy, Kabetogama, Namakan, and Sand Point--and the existing snowmobile safety portages would continue to be maintained. Overland snowmobile trails, however, would vary by alternative (see table I). Under all winter alternatives trail systems would be separated for cross-country skiing and snowmobiling. Also summer and winter trail systems would be independent of each other because areas in the park suitable for summer trails are not necessarily suited for winter trails and vice-versa. Trails would avoid critical wildlife habitat, areas of rare or unique plant species, and important cultural resources. All critical wildlife habitats, as well as areas for rare and unique plant species, would be determined relative to the proposed trail system before final routes were selected.

Under the draft plan about 80 miles of cross-country skiing and snowmobiling trails would be developed. Trails would be routed to avoid moose habitat in the southeastern portion of the Kabetogama Peninsula. Overland snowmobile trails would be provided so recreationists would not have to depend entirely on favorable ice conditions on the lakes and could enjoy a longer snowmobile season. These overland trails would be built at a standard to encourage a leisurely and resource-oriented park experience, and snowmobilers would be restricted by regulation to these trail routes. Much of a snowmobile trail the length of the Kabetogama Peninsula would consist of two parallel one-way routes. A cross-country ski trail would be built to Locator Lake, where a cabin would be provided so skiers could make overnight trips.

The no-action alternative would essentially maintain existing conditions, with approximately 28 miles of ski trails and snowmobile portages and 34 miles of unmaintained snowmobile routes. Informal snowmobile use of undesignated routes on the Kabetogama Peninsula would continue, in addition to the use of maintained safety portages. There would be no assurance that these routes would remain open as vegetation returned to more natural conditions.

The minimum access alternative would seek to preserve the largest area of wildlife habitat without human intrusions, and no routes other than existing snowmobile safety portages would be kept open on the Kabetogama Peninsula. Loop trails would be provided for cross-country skiing on the mainland. Altogether about 28 miles of winter trails would be available for use.

Trail development under the maximum access alternative would provide extensive opportunities for winter recreation by providing about 178 miles of trails throughout the park. Snowmobile trails on the Kabetogama Peninsula and in the southeastern portion of the park would provide the most extensive opportunities for snowmobiling and would also connect with existing trails outside the park. In addition to cross-country ski trails developed under the draft plan, a trans-peninsula ski trail would be built, and five overnight cabins would support multiday ski trips.

### SUMMER TRAIL ALTERNATIVES

Under all summer alternatives most of the existing trails would be maintained except for some minor additions or reroutings. Shuttle and tour boat service would be expanded to provide a pick-up and drop-off service for hikers and campers to get to trails on the Kabetogama Peninsula and various islands. This would allow visitors without boats to have many of the same hiking and camping opportunities as visitors with boats.

Under the draft plan a trail system would be developed to improve the water-oriented recreational activities already available in the park. The present trail system would be expanded to provide additional hiking opportunities for boaters, nature study groups, and guests at local resorts. Trails for handicapped visitors would also be provided. Altogether about 94 miles of trail would be available for visitors.

The minimum access (or no-action) alternative would basically continue the existing trail system, with minor changes to correct problems in access or design and to enhance the visitor experience. About 42 miles of trail would be provided, including hiking, interpretive, and canoe portage trails.

The maximum access alternative would provide about 124 miles of trails, with an emphasis on providing long-distance hiking opportunities. A new trans-peninsula hiking trail, in combination with the existing Cruiser Lake and Locator Lake trails, would provide fairly extensive east-west/north-south hiking opportunities on the Kabetogama Peninsula.

Table 1: Trail Development (in miles)

<u>Winter Alternatives</u>	<u>Cross-Country Ski Trails</u>	<u>Snowmobile Trails</u>	<u>Snowmobile Portages</u>	<u>Total</u>
Draft Plan	32.4	29.4	17.9	79.7
No Action	10.0	34.2*	17.9	62.1
Minimum Access	11.2	0	16.8	28.0
Maximum Access	101.4	58.9	17.9	178.2

<u>Summer Alternatives</u>	<u>Hiking Trails</u>	<u>Canoe Portages</u>	<u>Interpretive Trails</u>	<u>Handicap Trails</u>	<u>Total</u>
Draft Plan	72.7	9.4	7.2	5.1	94.4
Minimum Access	25.9	4.3	9.6	0	39.8
Maximum Access	105.5	6.1	7.2	5.1	123.9

---

\*Unmaintained routes.

## ENVIRONMENTAL CONSEQUENCES

The major effects from both winter and summer alternatives would be on vegetation, wildlife, visitor use, and the local economy (see table II). Effects on vegetation would be tree cutting and annual clearing of rapidly growing herbaceous plants, shrubs, and saplings. Effects on wildlife habitat would be most critical during winter; species of particular concern would be the gray wolf, bald eagle, white-tailed deer, and moose. Of the four winter alternatives, only the maximum access alternative would have potentially significant, adverse effects on wildlife. Currently, winter recreational trail use is unregulated, allowing activity to disperse across the 82,000 acres of lake surfaces. Research at Voyageurs and Isle Royale national parks shows that lakeshores are important areas for wolves, which hunt and travel within these shoreline corridors. Snowmobilers disrupt the movement and feeding of wolves along these shorelines. The cumulative effects of winter recreation on wolves would continue to be studied by park scientists and resource managers. If studies indicated that disruption of wolves along the shorelines or on land-based trails was at unacceptable levels, specific steps would be taken to mitigate snowmobile impacts. These steps could include closing areas of shoreline or land-based trails, designating lake surface routes, and increasing patrols and educational efforts.

Effects on wildlife under the summer alternatives would be insignificant except for potential effects on wolf denning and rendezvous sites,



loon-nesting habitat, and fisheries on interior lakes under the draft plan and maximum access alternative.

Trail system improvements would primarily affect use by visitors from outside the local region. The projected effect of nonlocal visitor expenditures shown in table II includes a partial reinvestment of these expenditures by local businesses, for example, for advertising and wages.

Potential effects on soils, air quality, water quality, wetlands, and cultural resources would be insignificant under all alternatives.



Table II: Summary of Major Environmental Effects

Winter Alternatives	Vegetation	Wildlife*	Visitor Use	Local Economy
Draft Plan	80 acres cut for trail construction; 118 acres affected by annual maintenance (0.06 percent of park's land area). No significant effect.	4,124 acres of habitat (3.1 percent of park's land area), including 3,222 acres on the Kabetogama Peninsula (4.3 percent of the peninsula's land area), could be affected by trail use. No significant effect.	Expanded opportunities for both snowmobiling and cross-country skiing.	Nonlocal visitor use over 10 years would likely increase faster than under the no-action alternative. A projected doubling of additional income would benefit local businesses and resorts. One-time construction expenditure--\$642,300; annual maintenance and management--\$179,500.
No-Action	39 acres affected by annual maintenance (0.03 percent of park's land area). No significant effect.	2,958 acres of habitat (2.2 percent of park's land area), including 2,643 acres on the Kabetogama Peninsula (3.5 percent of the peninsula's land area), could be affected by use of maintained trails and unmaintained snowmobile routes. No significant effect.	No improvement of existing visitor experience.	Based on existing use trends, nonlocal visitor use would continue to increase at a moderate rate. Expenditures would benefit local businesses and resorts. No construction; annual maintenance and management--\$112,400.
Minimum Access	13 acres cut for trail construction; 38 acres affected by annual maintenance (0.03 percent of park's land area). No significant effect.	1,411 acres of habitat (1.1 percent of park's land area), including 509 acres on the Kabetogama Peninsula (0.7 percent of the peninsula's land area), could be affected by trail use. No significant effect.	Prohibiting over-land snowmobiling on the Kabetogama Peninsula (other than safety portages) would adversely affect snowmobilers.	Nonlocal visitor use would increase more slowly than under no-action, and projected additional income would be 25 percent less. One-time construction expenditure--\$104,400; annual maintenance and management--\$112,200.
Maximum Access	207 acres cut for trail construction; 242 acres affected by annual maintenance (0.18 percent of park's land area). No significant effect.	8,842 acres of habitat (6.6 percent of park's land area), including 4,774 acres on the Kabetogama Peninsula (6.3 percent of the peninsula's land area), could be affected by trail use, with a potential reduction of ungulates and wolves.	Most extensive opportunities for snowmobiling and cross-country skiing.	Increases in nonlocal visitor use over 10 years would be the largest of any alternative. A projected tripling of additional income would benefit local businesses and resorts. One-time construction expenditure--\$1,948,800; annual maintenance and management--\$291,600.

Summer Alternatives	Vegetation	Wildlife*	Visitor Use	Local Economy
Draft Plan	37 acres cut for construction; 53 acres affected by annual maintenance (0.04 percent of park's land area). No significant effect.	Potential effects on wolf denning and rendezvous sites, loon-nesting habitat, and fisheries on interior lakes; but no significant long-term effect on habitat or wildlife populations.	Improved opportunities for hiking and nature study; handicap-accessible trails.	Construction--\$3,867,800; annual maintenance and management--\$201,700.
Minimum Access	8 acres cut for trail construction; 24 acres affected by annual maintenance (0.02 percent of park's land area). No significant effect.	No significant effect on habitat or wildlife populations.	Limited hiking opportunities; no handicap-accessible trails.	Construction--\$686,400; annual maintenance and management--\$134,900.
Maximum Access	51 acres cut for trail construction; 67 acres affected by annual maintenance (0.05 percent of park's land area). No significant effect.	Potential effects on wolf denning and rendezvous sites, loon-nesting habitat, and fisheries on interior lakes; otherwise no significant effect.	Most extensive opportunities for backcountry hiking and nature study; handicap-accessible trails.	Construction \$5,091,300; annual maintenance and management--\$242,200.

\*Estimates of acres of affected wildlife habitat are approximate and are only for comparison of alternatives.

## CONTENTS

INTRODUCTION	1
--------------	---

### PURPOSE OF AND NEED FOR THE PLAN

SCOPE OF THE TRAIL PLAN	7
Master Plan Direction	7
Planning Issues, Opportunities, and Concerns	8
Planning Objectives	10
Range of Alternatives	10
BACKGROUND INFORMATION	11
Snowmobiling and Wilderness Designation	11
Public Involvement	12
Interrelationships with Other Projects	12

### ALTERNATIVES FOR WINTER AND SUMMER TRAIL DEVELOPMENT

PLANNING AND DESIGN CONSIDERATIONS	17
ALTERNATIVES FOR WINTER TRAILS	19
Draft Plan	20
No-Action Alternative	22
Minimum Access Alternative	24
Maximum Access Alternative	26
ALTERNATIVES FOR SUMMER TRAILS	29
Draft Plan	30
Minimum Access (No-Action) Alternative	32
Maximum Access Alternative	34

### AFFECTED ENVIRONMENT

NATURAL RESOURCES	39
Geology and Topography	39
Vegetation	40
Plant Communities	40
Changes in Plant Communities	42
Fish and Wildlife	43
Fish	43
Bald Eagles	43



Water Quality	82	
Floodplains and Wetlands	82	
Cultural Resources	82	
Visitor Use	82	
Local Economy	83	
Minimum Access Alternative	84	
Soils	84	
Vegetation	84	
Wildlife	85	
Air Quality	86	
Water Quality	86	
Floodplains and Wetlands	86	
Cultural Resources	86	
Visitor Use	87	
Local Economy	87	
Maximum Access Alternative	88	
Soils	89	
Vegetation	89	
Wildlife	90	
Air Quality	91	
Water Quality	91	
Floodplains and Wetlands	91	
Cultural Resources	91	
Visitor Use	91	
Local Economy	92	
SUMMER ALTERNATIVES	96	
Draft Plan	96	
Soils	96	
Vegetation	96	
Wildlife	97	
Air Quality	99	
Water Quality	99	
Floodplains and Wetlands	100	
Cultural Resources	100	
Visitor Use	100	
Local Economy	102	
Minimum Access (No-Action) Alternative	102	
Soils	102	
Vegetation	103	
Wildlife	103	
Air Quality	104	
Water Quality	104	
Floodplains and Wetlands	104	
Cultural Resources	104	
Visitor Use	105	
Local Economy	105	
Maximum Access Alternative	106	
Soils	106	
Vegetation	106	
Wildlife	106	
Air Quality	108	

Water Quality	108
Floodplains and Wetlands	108
Cultural Resources	109
Local Economy	109
CONSULTATION AND COORDINATION	112
Contacts with Other Agencies and Consultants	112
Public Involvement in Trail Planning	112
Review of the <u>Draft Trail Plan and Environmental Assessment</u>	115
APPENDIXES	
A: TRAIL MAINTENANCE AND CONSTRUCTION STANDARDS	117
B: COST ESTIMATES	119
C: CONSULTATION WITH THE FISH AND WILDLIFE SERVICE	121
SELECTED BIBLIOGRAPHY	125
PLANNING TEAM AND CONSULTANTS	133

## MAPS

Region	3
Winter Trail Development	
Draft Plan	21
No-Action Alternative	23
Minimum Access Alternative	25
Maximum Access Alternative	27
Summer Trail Development	
Draft Plan	31
Minimum Access Alternative	33
Maximum Access Alternative	35
Wildlife	45
Gray Wolf Range in Northern Minnesota	49

## TABLES

1.	Winter Trails	28
2.	Summer Trails	36
3.	Estimated 1985 Average Expenditures by Skiers and Snowmobilers	63
4.	Estimated 1985 Expenditures by Winter Sports Participants	63
5.	Summary of Major Environmental Consequences-- Winter Alternatives	94
6.	Summary of Major Environmental Consequences-- Summer Alternatives	110





## INTRODUCTION

Voyageurs National Park was authorized in 1971 and was established in 1975. Its purpose is "to preserve, for the inspiration and enjoyment of present and future generations, the outstanding scenery, geological conditions, and waterway system which constituted a part of the historic route of the Voyageurs who contributed significantly to the opening of the Northwestern United States" (Public Law 91-661).

The park consists of approximately 219,128 acres, of which 85,506 acres are water. There are more than 30 lakes of all sizes in the park, and the French Canadian voyageurs used the various interconnecting waterways in the 1700s and early 1800s to transport pelts and trade goods between Montreal and the Canadian Northwest.

The Canadian Shield topography in the park has been shaped by glaciers, which scoured the land surface, gouged out lake and river beds, and set the stage for the later growth of vast boreal forests. Wildlife is abundant in the park. Ospreys, eagles, and great blue herons nest here, 48 varieties of fish are found in the park's lakes, and white-tailed deer, moose, gray wolves, and numerous small animals range through the forests.

Voyageurs is a park with few roads. Although the Kabetogama Peninsula, which dominates the center of the park, was heavily logged from the early 1900s until the park was authorized in 1971, it is now returning to a more natural state. The former logging roads are being overgrown by dense vegetation, and the park's plant communities are slowly recovering. For visitors the large lakes are the only means to travel a considerable distance in a short time; on land both travel and perspective are limited by thick forests, marshes, and bogs.

Summer is the most popular time of year for recreation in the Voyageurs country. Although the season is short, thousands of visitors come for fishing, motorboating, canoeing, and camping. During the long winter, however, the lake surfaces are frozen solid, and visitors use snowmobiles, skis, and automobiles to tour the park.



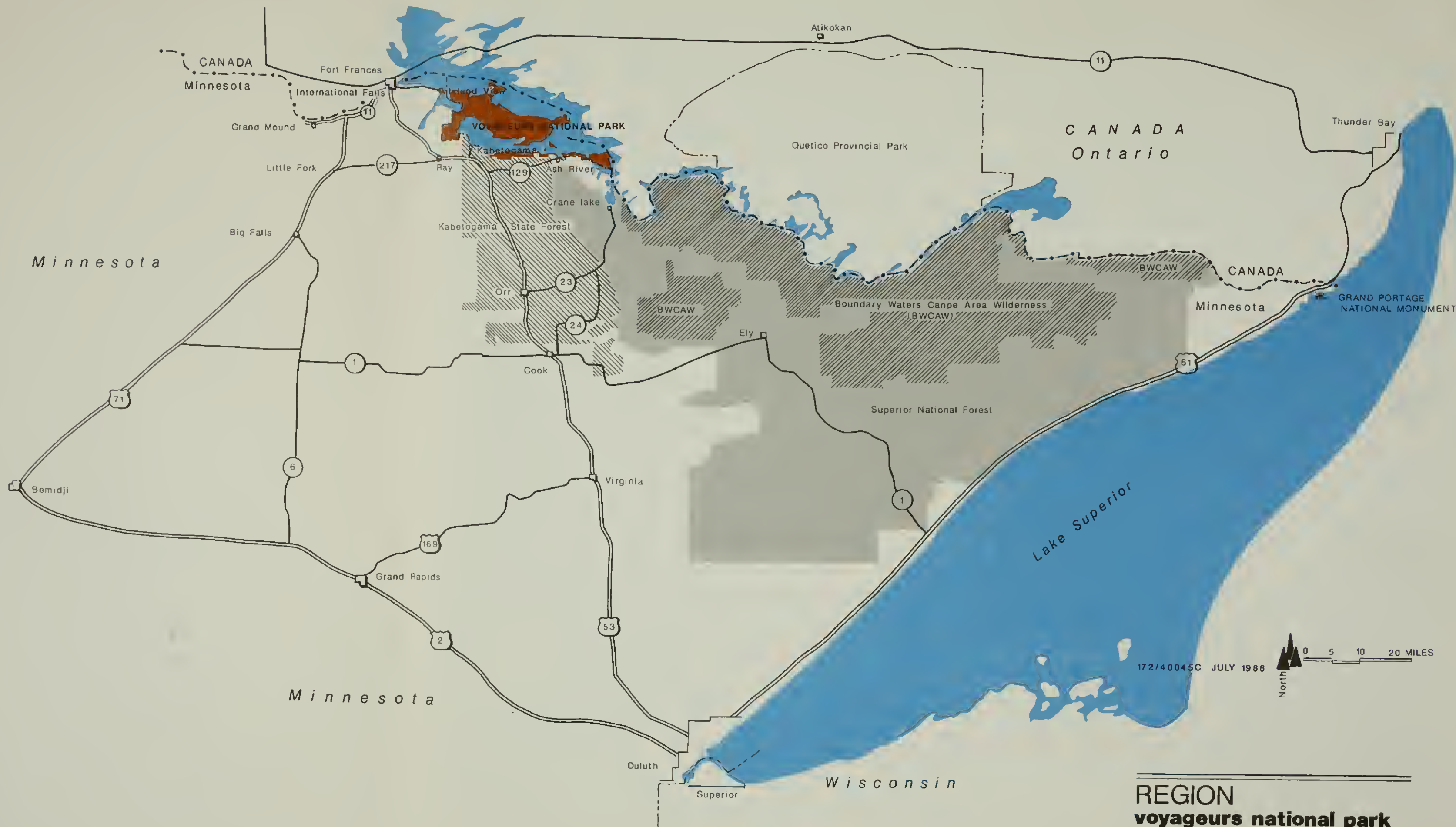


---

## REGION

# **voyageurs national park**

U.S. Department of the Interior / National Park Service



**REGION**  
**voyageurs national park**

**purpose of and need for the plan**





## SCOPE OF THE TRAIL PLAN

The purpose of this Draft Trail Plan and Environmental Assessment is to present alternatives for the development of land-based winter and summer trail systems at Voyageurs National Park, as called for by the park's Master Plan. This document also assesses the effects that trail development and use would have on natural and cultural resources as well as the local economy.

The plan addresses planning issues and management concerns, as well as opportunities, that have been identified during the planning process. It also ensures that legislative mandates to protect natural and cultural resources and to provide for public use are met.

To determine the scope of the trail plan, the direction provided by the Master Plan was reviewed, the park resources were carefully studied, and meetings were held with the public and governmental agencies to identify issues and concerns. Objectives for the trail plan were then developed to establish a framework for the alternatives. The results of this process are summarized below.

### MASTER PLAN DIRECTION

This Draft Trail Plan and Environmental Assessment has been prepared in accordance with the park's Master Plan, which was approved in 1980. That plan includes several proposals and concepts that directly or indirectly affect summer and winter trail access. These are summarized below:

Automobiles will be limited to external or peripheral parking areas, with provisions for regularly scheduled boat service between destination points on major lakes. Within the park, boats and hiking trails in the summer, and snowmobiles and cross-country ski trails in the winter, will be the primary means of access.

Overland trail systems will be established to provide access into the park by hiking, backpacking, snowmobiling, and cross-country skiing/snowshoeing.

Trail opportunities will be oriented to the park's resources, consistent with the protection of natural ecosystems.

Trail systems will provide visitors access to a cross section of park environments, as well as specific points of interest.

Trails will be linked with primary land and water access systems, and visitors will have options to get to trails by means of public shuttle boats.

Interpretive trails will be provided at Black Bay, Kabetogama Narrows (renamed Ash River), and Kettle Falls, and there will be special interpretive trails for handicapped visitors.

Canoe portages will continue to be provided to the smaller lakes.

Snowmobiling is an acceptable winter use of the major lakes, and portages will be maintained around hazardous ice areas. (However, the Master Plan did not determine the appropriateness of overland snowmobile trails; see "Background Information" section.)

Backcountry trails will be designed for travel times ranging from a few hours to several days.

Appropriate support facilities will be provided, for example, trailheads, landing docks, backcountry campsites, and canoe portage racks.

## PLANNING ISSUES, OPPORTUNITIES, AND CONCERNS

To respond to the directions outlined in the Master Plan, natural and cultural resources were studied, the existing trail system was analyzed, and public comments and suggestions were solicited about what type of trails and support facilities were desirable. As a result of these tasks, the following issues, opportunities, and concerns were identified and considered.

### Recreational Activities

Trail systems at Voyageurs must serve a variety of uses, including hiking, backpacking, nature study, canoe portaging, snowmobiling, and cross-country skiing. Trails should also provide a means for visitors to see and enjoy representative scenic features, habitats, and historic settings in the park.

There is a need for access into the park by means of cross-country skiing and snowmobiling. Trails for both types of use should give visitors a chance to experience a cross section of park environments. Land-based snowmobile trails that are marked and maintained would also provide opportunities for winter recreation during years when poor ice conditions do not permit travel on the major lakes.

The National Park Service has no long-term management strategy for snowmobiling in the park. Snowmobiling is currently allowed on the major lake surfaces, and the National Park Service maintains 15 traditionally used safety portages so that snowmobilers can avoid hazardous ice areas. According to the Master Plan, routes for snowmobiling on land will not be marked or maintained pending a determination of wilderness for Voyageurs. Because action on the park's wilderness recommendation has been deferred indefinitely, the future of overland snowmobile trails in the park has not been

decided. This situation leaves the National Park Service without a plan to control the location and conditions of winter use on park lands, resulting in an uncertain future for protecting the natural environment and for providing safe and enjoyable winter use for visitors. (See the "Background Information" section for a further discussion of the snowmobiling issue.)

Snowmobilers and skiers are user groups that have experienced conflicts in other areas of Minnesota because of dual uses of trails. Complaints by skiers relate to the sight and sound of snowmobiles detracting from their enjoyment of the natural environment, and the fact that snowmobile trails are physically harder for skiers to use because random vehicle tracks interrupt the continuity of ski tracks. However, with the advent of "skating" on cross-country skis, snowmobile trails are being used by cross-country skiers.

### Natural Resources

Since the 1890s the park ecosystem has been changed considerably as a result of human activities. Logging activities and fire suppression programs have changed the composition of vegetative communities, with resulting effects on wildlife populations. As the park's forests have matured since the cessation of logging, the number of deer has been declining. At the same time numbers of wolves, other carnivores, and scavengers have been decreasing. These population declines might further contribute to population reductions for bald eagles, red foxes, ravens, and other small carnivores. Consequently, any visitor-related development or use that would adversely affect these wildlife populations would be of concern.

Bald eagles have not been reproducing at levels necessary to replenish their population. Human disturbance of nesting birds, combined with decreased ungulate carrion as a food source, could contribute to further declines in numbers of bald eagles.

Trails that provide access to interior lakes could lead to overexploitation of fish populations.

The National Park Service is initiating a long-term program to restore absent and declining wildlife populations, primarily caribou, moose, elk, wolves, and other predators and scavengers. The improper location of trails could impede these restoration efforts.

### Local Economy

With recent declines in the mining and forest products industries, the local economy is evolving toward greater dependence on tourism. The economic viability of local resort communities could be affected by the location and extent of trail development.

## PLANNING OBJECTIVES

The following objectives for the trail plan were developed after considering the planning issues and management concerns, public comments, and the direction provided by the Master Plan.

Promote visitor enjoyment of Voyageurs National Park by providing safe trails that offer rewarding experiences, interesting destinations, and access to various examples of natural, scenic, and cultural resources.

Plan trails that blend with the topography and the environment and that minimize adverse effects on significant cultural and natural resources, including threatened species.

Minimize user group conflicts.

Design trails that are cost-effective to construct and efficient to maintain.

Ensure that trails complement and connect with trails outside the park, giving visitors a wide range of trail use opportunities and contributing to the local economy.

In meeting these objectives the National Park Service will comply with the legislation governing Voyageurs National Park and the Park Service.

## RANGE OF ALTERNATIVES

Based on the planning considerations discussed above, this Draft Trail Plan and Environmental Assessment presents a range of alternatives for both winter and summer trail use. Four alternatives are considered for winter use, ranging from no action (essentially continuation of existing conditions) to a maximum allowable level of development considering legislative mandates and the sensitivity of wildlife populations. Three alternatives are considered for summer use, ranging from minimum access (continuation of existing conditions) to a maximum level of development.

These alternatives are essentially the same as those presented in the Trail Plan Alternatives workbook in May 1986. However, a no-action alternative has been described for winter trail use to serve as a base for comparing the other alternatives, and changes have been made in the alignments of some trails as a result of environmental analysis. For example, a north-south snowmobile trail to Cruiser Lake has been dropped under the draft plan because of environmental considerations. The National Park Service has chosen the two preferred-access alternatives described in the workbook as the NPS proposals for the draft plan. These alternatives recommend moderate levels of trail development.



## BACKGROUND INFORMATION

### SNOWMOBILING AND WILDERNESS DESIGNATION

The legislation authorizing Voyageurs National Park called for a recommendation as to the suitability or unsuitability of park areas for designation as wilderness. The legislation also stated, "The Secretary [of the Interior] may, when planning for development of the park, include appropriate provisions for winter sports, including the use of snowmobiles."

The Master Plan stated that snowmobiling will continue to be allowed on the major lakes and safety portages, but snowmobiling on land will neither be discouraged nor encouraged through trail marking or maintenance of routes. Because the use of motorized vehicles directly affects wilderness suitability, the Master Plan recommended that a final decision about overland snowmobiling be made in conjunction with the ongoing wilderness study.

The draft Wilderness Recommendation and its accompanying Draft Environmental Impact Statement were issued in July 1980. Seven alternatives for wilderness designation, ranging from no wilderness to near-total wilderness (under which virtually no snowmobiling would be allowed), were presented and their environmental impacts assessed. The National Park Service decided to recommend the designation of 91,653 acres (69 percent of the park's land area) as wilderness or potential wilderness. The recommendation allowed for 32.6 miles of overland snowmobile trails on the Kabetogama Peninsula to provide east-west and north-south routes through the park. As of December 1987, a final wilderness recommendation has not been transmitted to Congress.

The NPS Management Policies state, "Roadless study areas subject to review for wilderness designation will be protected from activities which would endanger or alter their natural, primitive character until administrative study or the legislative process determines their suitability for wilderness designation." This Draft Trail Plan and Environmental Assessment was prepared under the assumption that snowmobiling conflicts with wilderness designation, but not with wilderness suitability, because the nonconforming use can be stopped at any time and the trails will quickly revegetate, thus restoring wilderness characteristics. Therefore, the development of snowmobile trails will not preclude further wilderness study and potential wilderness designation at Voyageurs.

The current use of undesignated, unmaintained land snowmobile routes within the park is permitted as an exception to NPS Management Policies, which state, "Where permitted, snowmobiles shall be confined to properly designated routes and water surfaces which are used by motorized vehicles or motorboats during other seasons." No routes on the Kabetogama Peninsula are currently used by motorized vehicles during other seasons. The NPS policies further state, "Snowmobiles shall not be permitted except where designated by the Service when such is consistent

with the park's natural, cultural, scenic and aesthetic values; safety considerations; park management objectives; and will not disturb the wildlife or damage other park resources." This policy as it applies to Voyageurs National Park was waived during the wilderness study process.

Over the past few years snowmobile trails have been developed outside the park, connecting the surrounding communities with the major lakes of Voyageurs. Informal snowmobile routes within the park that follow prepark roads and were usable in the 1970s are becoming overgrown and impassable. Meanwhile, more resorts in the Voyageurs area are attempting to develop year-round operations and are requesting the National Park Service to determine which long-range system of winter trails will be available to their clients so that they can continue to upgrade facilities and develop marketing packages. Consequently, it is timely for the National Park Service to resolve the issue of overland snowmobile routes in this Draft Trail Plan and Environmental Assessment.

## PUBLIC INVOLVEMENT

Public meetings were held in September 1985 as part of the scoping process for the trail planning effort. The purpose of the meetings was to identify what types of trails the public wanted and also their concerns about trail development and use. Based on these public meetings, as well as a preliminary analysis of the natural and socioeconomic environments, six alternatives were developed and presented to the public in a Trail Plan Alternatives workbook in May 1986. Public meetings were held in June to solicit comments on the alternatives, and mailback response forms were included with the workbooks so that people could respond individually. The planning team considered all of the public comments and revised the alternatives. The "Consultation and Coordination" section includes a summary of public comments on the planning workbook.

## INTERRELATIONSHIPS WITH OTHER PROJECTS

The staff at Voyageurs National Park is revising the Natural Resource Management Plan, which is scheduled for completion at approximately the same time as this Draft Trail Plan and Environmental Assessment. The revised plan addresses some of the resource problems that are also issues in planning for trail development. The components of the Natural Resource Management Plan that are interrelated with trail planning are summarized below.

Trail management--In terms of resource management, trail use would continue to be monitored and controlled in order to mitigate adverse effects, including displacement of wolves and their prey during the winter. The general trail routes indicated in this plan would be carefully located on the ground to ensure the protection of natural and cultural resources and also to provide safe and enjoyable visitor experiences.

Fire management--The park's 1987 approved Wildland Fire Management Plan is to be implemented. See the "Affected Environment" section for a brief description of how prescribed fires could help restore park ecosystems.

Restoration of absent and declining native wildlife populations--Populations of caribou and elk, which are important prey species for the maintenance of the gray wolf population, would be reestablished if feasible. The current status of the wolf and the expected benefits of this restoration program are described in the "Affected Environment" section.

Bald eagle and osprey management--A more comprehensive program for management, monitoring, and research is recommended, with emphasis on regulating trail use in order to maintain critical habitat.

Wolf management--Management, monitoring, and research would be expanded to a year-round program, with attention given to mitigating potential disturbances caused by snowmobiling, skiing, hiking, and backpacking. This program would also include actions necessary to comply fully with the Endangered Species Act and to meet the objectives of the 1981 Recovery Plan for the Eastern Timber Wolf. A research program has been started to monitor radio-collared wolves.

Other issues of concern that are addressed in the Natural Resource Management Plan are management of black bears, common loons, beavers, fisheries, rare and exotic plants, hazard trees, water resources, lake country and backcountry sites, and interior lakes. Separate plans that have been prepared and relate to the Draft Trail Plan include the Lakecountry and Backcountry Site Management Plan (NPS 1988), plus its environmental assessment (NPS 1986b), and the Human/Bear Management Plan (NPS 1986a).

Depending on program approval and funding, resource management programs could be implemented at approximately the same time as an approved trail plan. Trail and facility construction will not begin until funding is available to mitigate any potential adverse effects.

Another project that is related to trail planning is the development of a public shuttleboat system. As recommended by the Master Plan, public shuttle boats are to be used to link primary land and water access systems. Since 1983 two NPS concessioners have offered visitors regularly scheduled boat trips to Kettle Falls and other destinations for a fee. Commercial use licenses have also been issued to individuals to provide transportation services. The present shuttleboat program is still in its formative stages.





**alternatives for winter and summer trail development**



## PLANNING AND DESIGN CONSIDERATIONS

The four alternatives for winter trail systems and the three alternatives for summer trail systems are described in this section. Certain planning and design considerations would affect all alternatives, as described below.

Trail design and construction would have to consider various physical conditions. The glaciated landscape of Voyageurs consists of a series of low rock ridges and countless low-lying areas of large and small lakes, wetlands, and bogs. The rolling terrain has very few level areas except for frozen lake surfaces in winter. Vegetation throughout the park is dense, and areas of rock outcrops are smooth and rounded, with little or no soil. Because of these conditions, trails in rocky areas could require extensive work to create a relatively level treadway, and in wetland areas extensive planking or numerous small bridges would be needed. Vegetation along trail routes would have to be routinely cut back to provide a trail corridor wide enough for users. (Trail construction and maintenance standards are described in appendix A.)

Potential impacts on natural and cultural resources were major factors in determining general locations for trails. Sensitive resources (such as wintering wildlife concentration areas, rare or unique plant species, and important cultural resources) would be avoided, and all trails would be routed to reduce the need for blasting or other extensive rock work. Maps for the alternatives show the approximate routes; however, exact trail alignments would not be determined until construction was ready to begin.

Trails would be designed and constructed to provide for a variety of recreational and educational uses, including cross-country skiing, snowshoeing, and snowmobiling in winter and backcountry hiking, backpacking, canoe portaging, interpretation/education, and handicap access in summer. Separate trail systems for winter and summer use would be constructed because the best locations for summer hiking trails are not always the best locations for winter trails. The ideal locations for hiking trails are generally on high ground to avoid wet areas whenever possible; however, these same high areas tend to be too rocky and frequently have poor snow conditions for skiing and snowmobiling. Winter trail corridors would be designed to follow wetland and bog areas as much as possible because these areas provide better skiing and snowmobiling conditions. Separate trail systems would also be provided for skiers and snowmobilers because these two user groups have different interests that cannot be accommodated on the same trail system.

Summer and winter trails would be either one-way loop trails or linear trails of various lengths, and they would be routed through a cross section of park environments to introduce visitors to the conifer and mixed-hardwood forests. Destinations would include scenic overlooks, wildlife-viewing areas, unique natural features, small interior lakes, and historic sites, as well as visitor activity areas, backcountry campsites, developed areas, and trails and communities outside the park.

Trails would be designed to encourage a leisurely, resource-oriented experience; long, straight trail sections, sharp curves, and steep grades would be avoided. Where winter and summer trails intersected, the off-season trail would be camouflaged by means of trail design and layout so as to discourage unseasonal use and to minimize the visual impact. If these efforts did not discourage use, barriers of natural materials or closure signs could be used.

Trail maps would be available at all visitor contact centers and at major trailheads. Signs would provide trail names, destinations, and distances, as well as general safety and interpretive information. Additional signs could provide more detailed information or orientation, identify interesting features, or provide wayside interpretation. Speed limit signs would be posted for snowmobile trails. All signs would be limited to the minimum number necessary for visitor safety and orientation. Small metal or plastic markers would be used in areas where trail routes were not apparent. Rock cairns would be used to mark summer trails that cross extensive rock outcrops. For snowmobile use, directional markers or route indicators would be used on the larger lakes to warn visitors about hazardous ice areas and to mark portages. One or more of the most heavily used portages could be lighted at the trail ends to orient snowmobilers traveling in the dark on the lake surfaces.

Toilets would be available at developed areas, most campsites, and at some of the more popular trailheads. Trail users would be encouraged to carry or treat all drinking water.

## ALTERNATIVES FOR WINTER TRAILS

Under all winter trail alternatives snowmobile use would continue to be allowed on the frozen surfaces of Rainy, Kabetogama, Namakan, and Sand Point lakes. Existing snowmobile portages would also continue to be maintained to provide safe access around areas of dangerous ice, generally along narrow straits where lake currents make the ice very thin and dangerous.

Wildlife populations would be monitored and studied as described in the park's Natural Resource Management Plan to detect any potential adverse effects resulting from recreational use. Management actions, such as temporary closures of trail segments in areas around eagle nests or other sensitive habitat areas, would be taken as needed to mitigate adverse effects.

Four alternatives are considered for winter trail systems. Under the draft plan trails would be provided for cross-country skiing and snowmobiling on the Kabetogama Peninsula. The no-action alternative would essentially maintain existing conditions, and besides use of safety portages, only informal snowmobile use on undesignated routes would be allowed on the Kabetogama Peninsula. The minimum access alternative would restrict snowmobile use to the frozen surfaces of the park's major lakes and safety portages; no other overland use would be allowed. The maximum access alternatives would provide additional trails for snowmobilers and cross-country skiers throughout the park. Mileages for trail segments are shown in table 1. Cost estimates for construction and maintenance of winter trails, as well as for resources management and visitor protection, are included in appendix B.

## DRAFT PLAN

Under the draft plan approximately 79.7 miles of trails would be provided for skiers and snowmobilers (see table 1). Trails would be routed to avoid moose habitat in the southeastern portion of the Kabetogama Peninsula. Overland snowmobile trails would be provided so recreationists would not have to depend entirely on favorable ice conditions on the lakes and could enjoy a longer season. These overland trails would be built at a standard to encourage a leisurely and resource-oriented park experience, and snowmobilers would be restricted by regulation to these trail routes.

Approximately 29.4 miles of snowmobile trails and an additional 17.9 miles of snowmobile safety portages would be provided. All snowmobile trails and portages would be constructed and maintained for two-way use except a new trail the length of the Kabetogama Peninsula. This trail would provide access to a limited number of interior lakes, a cross section of the park's forest environments, and the historic Kettle Falls Hotel (closed in winter). The new trail would be constructed as two parallel, curving, one-way trails to provide snowmobilers with an experience more oriented to the park setting rather than one geared to high-speed snowmobile travel. The parallel trails would be no more than 300 feet away from each other to keep the zone of impact relatively narrow but still provide a sense of being separated from other snowmobilers.

For cross-country skiers 32.4 miles of trail would be provided. Skiing on the mainland would be on loop trails following the proposed summer interpretive trails at State Point and the Rainy Lake visitor center. A ski trail would also be developed in the vicinity of Daley Brook, from the Ash River Trail (St. Louis County Road 129) to Nebraska Bay. The portion of this trail outside the park boundary would be constructed under a cooperative agreement with the state. Additional loop trails would be developed on the west end of the Kabetogama Peninsula, which would be more accessible to residents and visitors coming from International Falls. The existing informal trail loop near Cranberry Creek on the peninsula east of Black Bay would be relocated to more favorable terrain nearby, and two lunch shelters would be provided on the loops. An extension from the loops would continue to the west end of Locator Lake, where an overnight cabin could be reserved by skiers who wanted to continue off-track along the Chain of Lakes. A nominal fee could be collected to help defray maintenance costs. Ski trails in the southern part of the park at State Point and near Ash River would serve guests of nearby resorts and would also introduce visitors to a cross section of park resources.



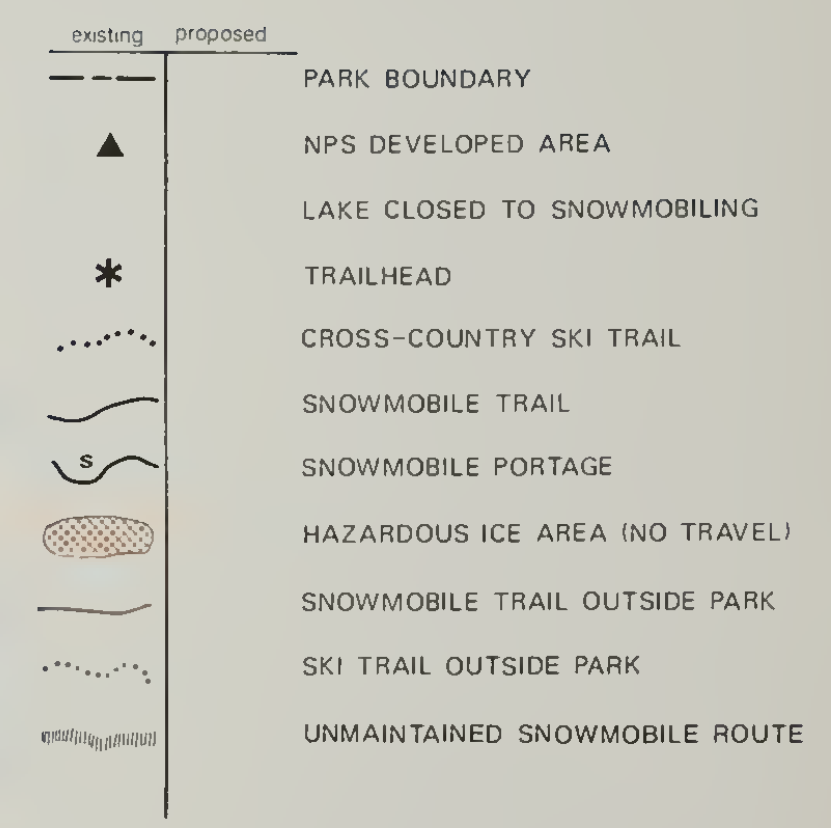


## NO-ACTION ALTERNATIVE

Even before its establishment as a national park in 1975, Voyageurs was a popular winter and summer recreation area. Boise Cascade Corporation, the previous owner of most of the land, provided public trails and portages for various recreational activities, including cross-country skiing and snowmobiling. Following establishment of the park, the National Park Service continued to maintain and improve some of these existing trails and portages.

Under the no-action alternative approximately 62 miles of winter cross-country ski and snowmobile trails or routes would continue to be available (see table 1). A 10-mile cross-country ski loop system at Black Bay provides opportunities for beginner and intermediate skiers. For snowmobilers there are approximately 17.9 miles of designated and maintained two-way snowmobile safety portages, plus about 34 miles of overland undesignated and unmaintained snowmobile routes. These informal routes provide access to some small interior lakes on the peninsula that are popular destinations for winter visitors (Chain of Lakes, Shoepack Lake, and Cruiser Lake). Without periodic maintenance, including removal of vegetation, there would be no assurance that these routes would remain open.





NO-ACTION ALTERNATIVE

# WINTER TRAIL DEVELOPMENT

## voyageurs national park

U.S. Department of the Interior / National Park Service

Note: Snowmobile and ski trails outside the park are shown on this map to demonstrate how these routes would interrelate with similar routes and trails inside the park.

## MINIMUM ACCESS ALTERNATIVE

The minimum access alternative would seek to preserve the largest area of wildlife habitat without human intrusion, and no formal winter trails or informal routes other than existing snowmobile safety portages would be kept open on the Kabetogama Peninsula. Approximately 28 miles of winter trails would be provided under this alternative (see table 1).

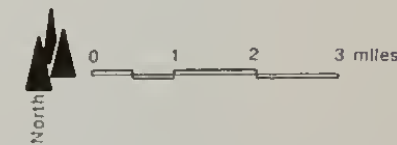
The existing Black Bay cross-country ski trail and existing undesignated snowmobile land routes in the park would be closed. Skiing on the mainland, as described under the draft plan, would be provided on three trails: two loop trails following the proposed summer interpretive trails at State Point and the Rainy Lake visitor center, and a third trail in the Daley Brook vicinity. A total of approximately 11.2 miles of cross-country ski trails and 16.8 miles of snowmobile safety portages would be provided under this alternative.



Note All land areas of park except for designated trails would be closed to snowmobiles.  
Snowmobile and ski trails outside the park are shown on this map to demonstrate how these routes would interrelate with similar routes and trails inside the park.

existing	proposed	
		PARK BOUNDARY
		NPS DEVELOPED AREA
		LAKE CLOSED TO SNOWMOBILING
		TRAILHEAD
		CROSS-COUNTRY SKI TRAIL
		SNOWMOBILE TRAIL
		SNOWMOBILE PORTAGE
		HAZARDOUS ICE AREA (NO TRAVEL)
		SNOWMOBILE TRAIL OUTSIDE PARK
		SKI TRAIL OUTSIDE PARK

172/40035G JULY 1988



MINIMUM ACCESS ALTERNATIVE

## WINTER TRAIL DEVELOPMENT

**voyageurs national park**

U.S. Department of the Interior / National Park Service



## MAXIMUM ACCESS ALTERNATIVE

Trail development under the maximum access alternative would provide extensive opportunities for winter recreation by providing approximately 178.2 miles of winter trails throughout the park (see table 1).

Some 58.9 miles of snowmobile trails and 17.9 miles of snowmobile safety portages would be provided. Most of the snowmobile trails described under the draft plan would be developed. Parallel one-way trails on the Kabetogama Peninsula would provide access to Kettle Falls, and additional two-way trails would provide access to the Chain of Lakes, Shoepack Lake, Cruiser Lake, and Lost Bay. A new snowmobile trail in the southeastern portion of the park would provide additional connections and access to the Voyageur Trail (a state grant-in-aid trail) outside the park.

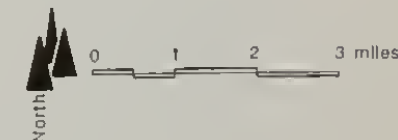
About 101.4 miles of cross-country ski trails would be developed. In addition to the ski trail loops described for the draft plan, a ski trail the length of the Kabetogama Peninsula would skirt the northern edge of the Chain of Lakes and continue to Kettle Falls. It would be separated from the snowmobile trail to eliminate conflicts with snowmobilers. Three overnight cabins would support multiday ski trips. The cabins could be reserved, and a nominal fee could be collected to help defray maintenance costs. A second ski trail along the south edge of the park would extend from West Kabetogama to Crane Lake and would be routed through Ash River. Two overnight cabins would be provided along this trail.



Note All land areas of park except for designated trails would be closed to snowmobiles.  
Snowmobile and ski trails outside the park are shown on this map to demonstrate how these routes would interrelate with similar routes and trails inside the park.

- | existing | proposed |                                |
|----------|----------|--------------------------------|
| ---      | ---      | PARK BOUNDARY                  |
| ▲        | ▲        | NPS DEVELOPED AREA             |
| ■        | ■        | LAKE CLOSED TO SNOWMOBILING    |
| *        | *        | TRAILHEAD                      |
| ...      | ...      | CROSS-COUNTRY SKI TRAIL        |
| ---      | ---      | SNOWMOBILE TRAIL               |
| S        | S        | SNOWMOBILE PORTAGE             |
| ■        | ■        | HAZARDOUS ICE AREA (NO TRAVEL) |
| ---      | ---      | SNOWMOBILE TRAIL OUTSIDE PARK  |
| ...      | ...      | SKI TRAIL OUTSIDE PARK         |
| □        | □        | LUNCH SHELTER                  |
| ■        | ■        | OVERNIGHT CABIN                |

172/40037G JULY 1988



## MAXIMUM ACCESS ALTERNATIVE WINTER TRAIL DEVELOPMENT

**voyageurs national park**

U.S. Department of the Interior / National Park Service



Table 1: Winter Trails (in miles)

	No-Action Alternative (Existing Conditions)	Draft Plan	Minimum Access Alternative	Maximum Access Alternative
<u>Snowmobile Portages</u>				
Black Bay - Moose Bay	2.6	2.6	2.6	2.6
Grassy Portage (Namakan Lake - Grassy Bay)	0.3	0.3	0.3	0.3
Kohler Bay	0.2	0.2	0.2	0.2
Laurins Bay to Kettle Falls	1.9	1.9	1.9	1.9
Long Slu to Lost Lake	0.5	0.5	0.5	0.5
Moose River Grade	1.6	1.6	1.6	1.6
Mukooda Lake North (Mukooda Lake - Sand Point Lake)	0.3	0.3	0.3	0.3
Mukooda Lake South (Crane Lake - Mukooda Lake)	0.8	0.8	0.8	0.8
Net Lake (Junction Bay - Net Lake)	0.1	0.1	0.1	0.1
Net Lake South to Park Boundary	--	1.1	1.1	1.1
Ranta Bay to Park Boundary	0.5	0.5	0.5	0.5
Squaw Narrows (Mica Bay - Johnson Bay)	2.4	2.4	2.4	2.4
Squirrel Narrows (Mica Bay - Kettle Falls)	2.2	2.2	2.2	2.2
Sullivan Bay - Kabetogama Lake	0.4	0.4	0.4	0.4
Sullivan Bay - Moose Bay	0.3	0.3	0.3	0.3
Swansons Bay (Sand Point Lake)	0.2	0.2	0.2	0.2
Tar Point (Ash River - Namakan Lake)	0.1	0.1	0.1	0.1
Lost Bay to Saginaw Bay	0.6	0.6	0.6	0.6
Mukooda Lake South (Crane Lake - Mukooda Lake)	1.3	1.3	1.3	1.3
Mukooda Lake/Sand Point Junction - Sand Point Lake	0.1	0.1	0.1	0.1
Namakan Narrows	0.4	0.4	0.4	0.4
Subtotal	16.8	17.9	17.9	17.9
<u>Snowmobile Trails/Routes</u>				
Beast Lake to Mica Bay	0.5*	--	--	--
Black Bay (Rainy Lake - Kabetogama Lake)	7.5*	--	--	--
Chain of Lakes (Locator Lake - Cruiser Lake)	9.0*	--	--	8.0
Cranberry Creek (Rainy Lake - Black Bay Portage)	2.5*	--	--	--
Cruiser Lake (Lost Bay - Browns Bay)	6.6*	--	--	6.6
Ek Lake - Lost Bay	0.2*	--	--	--
Gold Portage (Park Boundary - Black Bay Portage)	--	3.4	--	3.4
Kabetogama Peninsula (Moose Bay - Kettle Falls)	--	26.0	--	26.0
Little Trout Lake (Grassy Bay - Little Trout Lake)	0.2*	--	--	--
Rollick Creek - Net Lake	--	--	--	8.9
Shoepack Lake (Kabetogama Lake - Shoepack Lake)	3.2*	--	--	6.0
Voyageur Trail (state grant-in-aid trail)	4.5**	--	--	--
Subtotal	34.2	29.4	0.0	58.9
<u>Cross-Country Ski Trails</u>				
Black Bay Loop	10.0	10.0	--	10.0
Crane Lake Loop	--	--	--	7.4
Crane Lake - Kabetogama Lake	--	--	--	31.2
Cruiser Lake (Lost Bay - Browns Bay)	--	--	--	9.0
Black Bay - Locator Lake	--	11.2	--	--
Cranberry Creek - Kettle Falls	--	--	--	28.2
Rainy Lake Visitor Center Loop	--	3.3	3.3	3.3
Daley Brook (Ash River Trail - Nebraska Bay)	--	5.2	5.2	9.6
State Point Loop	--	2.7	2.7	2.7
Subtotal	10.0	32.4	11.2	101.4
Total Miles	62.1	79.7	28.0	178.2

\*Unmaintained snowmobile route.

\*\*State-funded trail maintained by a local snowmobile club; portion within park scheduled to be relocated.

## ALTERNATIVES FOR SUMMER TRAILS

Three alternative trail systems are being considered for summer use--the draft plan, the minimum access or no-action alternative (which would continue existing conditions, with some minor improvements), and the maximum access alternative. Under these alternatives most existing trails would be maintained except for some minor additions or reroutings. New trails under the draft plan and maximum access alternative would include interpretive trails, handicap-accessible trails, and extended hiking or backpacking trails. Mileages for trail segments are shown in table 2. Cost estimates for trail construction, maintenance, resource management, and visitor protection are included in appendix B. Support facilities would be provided under all summer alternatives, including docks at water accessible trailheads, boat-launching ramps, toilets at some trailheads, canoe rest stands, bulletin boards, and benches.

## DRAFT PLAN

A trail system would be developed to enhance the water-oriented recreational activities already available in the park. The intent would be to give visitors in the park for just one day a chance to take short hikes and to get a firsthand impression of park resources, and also to give visitors staying several days a variety of hiking opportunities. Approximately 94.4 miles of summer trails would be provided: 72.7 miles of hiking trails, 7.2 miles of interpretive trails, 5.1 miles of handicap-accessible trails, and 9.4 miles of canoe portages (see table 2).

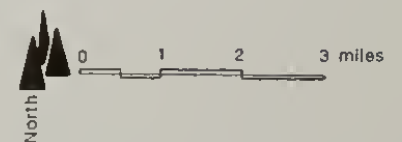
Additional hiking opportunities would be provided for boaters, nature study groups, and guests at local resorts. Minor changes would be made to existing trails in order to correct problems in access or design or to enhance the visitor experience. For example, a loop trail south of Cruiser Lake would be closed to simplify the trail system. A new trail to Lucille Lake would cross a broad, glaciated rock ridge and provide excellent views of the landscape. Trails on the Kabetogama Peninsula would be accessible from the major lakes by private boats, as well as shuttle or tour boats. Canoe portages would also be improved, providing easier access to several interior lakes on the Kabetogama Peninsula. Other additions would include a new hiking trail from Marion Bay south to Locator Lake, plus numerous scenic loop trails on islands and at other areas accessible by boat. A new hiking trail north of Kettle Falls would extend hiking opportunities for hotel visitors and guests. Backpacking opportunities would be limited primarily to the 24-mile Cruiser Lake trail system or to cross-country (bushwhacking) travel.

Additional interpretive trails would introduce visitors to a wider range of park resources. The trail at the Rainy Lake visitor center would be suitable for interpretive group hikes. Handicap-accessible sections of new trails would be provided at the Rainy Lake visitor center, Blind Ash Bay, and Kettle Falls. Trailheads for a new hiking trail loop at State Point, and for interpretive trails at the Rainy Lake visitor center and Blind Ash Bay, would be accessible by car.



existing	proposed	
		PARK BOUNDARY
		NPS DEVELOPED AREA
		TRAILHEAD
		CANOE PORTAGE
		HIKING TRAIL
		INTERPRETIVE TRAIL
		HANDICAP-ACCESSIBLE TRAIL

172/40040E JULY 1988



DRAFT PLAN

## SUMMER TRAIL DEVELOPMENT

**voyageurs national park**

U.S. Department of the Interior / National Park Service

#### MINIMUM ACCESS (NO-ACTION) ALTERNATIVE

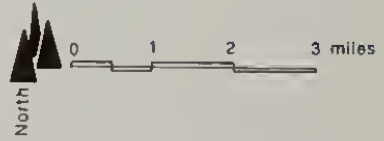
The minimum access (or no-action) alternative would basically continue the existing situation, but minor changes would be made to correct problems in access or design or to enhance the visitor experience. For example, a loop trail south of Cruiser Lake would be closed to simplify the trail system. A new trail to Lucille Lake would cross a broad, glaciated rock ridge, providing excellent views of the landscape; this trail would be the only trail in the southeastern portion of the park. Trailheads for a new hiking trail loop at State Point, and for new interpretive trails at the Rainy Lake visitor center and Blind Ash Bay, would be accessible by car. About 42.3 miles of summer trails would be provided under this alternative: 28.4 miles of hiking trails, 9.6 miles of interpretive trails, and 4.3 miles of canoe portages (see table 2).





existing	proposed	
---	---	PARK BOUNDARY
▲	▲	NPS DEVELOPED AREA
*	*	TRAILHEAD
c	c	CANOE PORTAGE
~~~~~	~~~~~	HIKING TRAIL
.....	o-o-o-o-o	INTERPRETIVE TRAIL

172/40038F JULY 1988



MINIMUM ACCESS (NO-ACTION) ALTERNATIVE

# SUMMER TRAIL DEVELOPMENT

**voyageurs national park**

U.S. Department of the Interior / National Park Service



## MAXIMUM ACCESS ALTERNATIVE

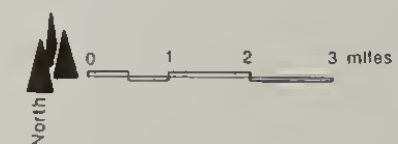
Under the maximum access alternative additional trails would be provided for long-distance hiking by expanding the trail system described under the draft plan. This alternative would provide a full range of hiking opportunities, and trails would be accessible by car or boat. Approximately 123.9 miles of summer trails would be provided: 105.5 miles of hiking trails, 7.2 miles of interpretive trails, 5.1 miles of handicap-accessible trails, and 6.1 miles of canoe portages (see table 2).

A new trans-peninsula trail and the existing Cruiser Lake and Locator Lake trail systems would provide fairly extensive east-west/north-south hiking opportunities on the Kabetogama Peninsula. Another trail would be built along the south shore of Kabetogama Lake from Nebraska Bay to the Ash River community by way of the Ash River visitor contact station; this trail would be accessible by road. A longer trail near Mukooda Lake would provide loop hiking opportunities near Crane Lake. As described under the draft plan, interpretive trails and trails accessible to handicapped visitors would be provided at the Rainy Lake visitor center, Blind Ash Bay, and Kettle Falls.



existing	proposed
	PARK BOUNDARY
	NPS DEVELOPED AREA
	TRAILHEAD
	CANOE PORTAGE
	HIKING TRAIL
	INTERPRETIVE TRAIL
	HANDICAP-ACCESSIBLE TRAIL

17240039F JULY 1988



## MAXIMUM ACCESS ALTERNATIVE SUMMER TRAIL DEVELOPMENT

**voyageurs national park**

U.S. Department of the Interior / National Park Service

Table 2: Summer Trails (in miles)

	Existing Conditions	Draft Plan	Minimum Access Alternative	Maximum Access Alternative
<u>Hiking Trails</u>				
Big Island Loop (Rainy Lake)	--	4.6	--	4.6
Blue Fin Bay Loop (Kabetogama Lake)	--	4.4	--	4.4
Cruiser Lake System (Lost Bay - Browns Bay)	16.8	24.5	19.3	22.1
Dryweed Island Loop (Rainy Lake)	--	2.9	--	2.9
Eks Bay/Ek Lake Cut Across	0.9	0.9	0.9	0.9
Hammer Bay - Grassy Bay	--	6.0	--	6.0
Kabetogama Peninsula (Locator Lake - Anderson Bay)	--	--	--	21.6
Kettle Falls Loop	--	3.8	3.2	3.6
Kettle Falls (Rainy Lake - Dam)	0.1	0.1	0.1	0.1
Kettle Falls (Road - Dam)	0.1	0.1	0.1	0.1
Kettle Falls (Namakan Lake - Dam)	0.2	0.2	0.2	0.2
Kettle Falls (Namakan Lake - Hotel)	0.1	0.2	0.2	0.2
Locator Lake - Marion Bay	--	4.1	--	5.3
Lost Bay	--	2.6	--	2.6
Lucille Lake - Browns Bay	--	3.6	1.8	3.6
Moxie Island (Kabetogama Lake)	--	1.7	--	1.7
Mukooda Lake Loop	--	3.4	--	6.0
Namakan Island Loop	--	3.6	--	3.6
Nebraska Bay - Ash River	--	--	--	7.0
Randolph Bay Loop (Namakan Lake)	--	2.7	--	2.7
Rottenwood Island Loop (Kabetogama Lake)	--	0.7	--	0.7
Shoepack Lake - Jorgens Lake	--	--	--	3.0
State Point Loop	--	2.8	2.6	2.6
Subtotal	18.2	72.7	28.4	105.5
<u>Canoe Portages</u>				
Beast Lake - Mica Bay	0.5	0.5	0.5	--
Cranberry Creek	1.2	1.2	1.2	1.2
Eks Bay - Jorgens Lake	1.2	--	1.2	--
Eks Bay - Jorgens Lake - Little Shoepack Lake	--	2.4	--	--
Gold Portage	0.2	0.2	0.2	0.2
Grassy Portage	0.3	0.3	0.3	0.3
Little Shoepack Lake - Shoepack Lake	--	0.2	--	--
Little Trout Lake - Grassy Bay	0.2	0.2	0.2	--
Loiten Lake - Quill Lake	--	0.2	--	0.2
Long Slu - Lost Lake	0.5	0.5	0.5	0.5
Mukooda Lake - Sand Point Lake	0.1	0.1	0.1	--
Net Lake - Junction Bay	--	--	--	0.1
O'Leary Lake - Hammer Bay	0.1	0.1	0.1	0.1
Quill Lake - War Club Lake	--	0.5	--	0.5
Shoepack Lake - Kempton Bay	--	1.2	--	1.2
Shoepack Lake - Loiten Lake	--	1.8	--	1.8
Subtotal	4.3	9.4	4.3	6.1
<u>Interpretive Trails</u>				
Black Bay Loop	3.2	3.2	3.2	3.2
Blind Ash Bay	--	2.5	2.5	2.5
Kabetogama Lake - Locator Lake	1.5	1.5	1.5	1.5
Rainy Lake Visitor Center Loop	--	--*	2.4	*
Subtotal	4.7	7.2	9.6	7.2
<u>Handicap Trails</u>				
Blind Ash Bay	--	1.7	--	1.7
Kettle Falls	--	1.0	--	1.0
Rainy Lake Visitor Center Loop	--	2.4	--	2.4
Subtotal	0	5.1	0	5.1
Total	27.2	94.4	42.3	123.9

\*The interpretive trail at the Rainy Lake visitor center would also be handicap accessible and is included there.

**affected environment**



## NATURAL RESOURCES

Extensive information on the natural, cultural, and socioeconomic resources of Voyageurs National Park and the region was collected in conjunction with the recent master planning effort. That information is presented in the Final Environmental Statement for the Master Plan (NPS 1979) and its cited references. General information about the region's natural, cultural, and socioeconomic resources is summarized below.

Voyageurs National Park lies within the forested lake country along Minnesota's northeastern border with Ontario, Canada, and it is part of a relatively undisturbed ecosystem of 2.7 million acres that includes the 1.2-million-acre Boundary Waters Canoe Area Wilderness and the 1.1-million-acre Quetico Provincial Park. This region typifies the Canadian shield topography--a forested land that has been shaped by glaciation into rolling hills and a complex system of lakes and waterways.

Voyageurs encompasses 219,128 acres, of which 85,506 are water. The main landmass is the heavily forested 75,000-acre Kabetogama Peninsula, which is predominantly undeveloped and accessible only by air or water. The peninsula is nearly surrounded by large lakes, and its shoreline, forest, and smaller interior lakes provide for much of the popular land-based summer and winter recreational opportunities in the park. Because of the peninsula's isolation, conditions are ideal for forest and wildlife management. Natural water barriers make it possible to use managed fire to help restore more natural forest and wildlife habitat conditions. The peninsula's isolated situation also makes it easier to monitor and protect wildlife populations. Consequently, the Kabetogama Peninsula is a key area for park resource management programs to restore natural forest and wildlife conditions, as well as being a center for recreational activity.

## GEOLOGY AND TOPOGRAPHY

Many of the park's geologic features are distinctive and are not found in the same combination in other U.S. national parks. The park is located in the southern portion of the Superior province of the Canadian Shield, a vast core of Precambrian rocks that forms the nucleus of the North American continent. The landscape was shaped during four periods of glaciation, resulting in the exposure of Precambrian formations, the deposition of unconsolidated morainal materials, and the creation of lakes and wetlands.

Land elevations in the park are generally not more than 100 or 200 feet above the lakes' elevations. Rocky outcroppings and abrupt increases in elevations along some sections of the lakeshores create an impression of rugged beauty.

Subsequent weathering of the glaciated landscape and the reestablishment of vegetation added a thin soil mantle to many areas of the park. In the



eastern portion of Voyageurs the bedrock is well exposed, particularly along the shoreline cliffs. In the western part and on the Kabetogama Peninsula, the land is flatter, and the bedrock is covered by soil, unconsolidated glacial materials, and swamplands. Rock outcrops, shallow soils, and poorly drained areas are constraints on the construction and maintenance of trails, campsites, and other facilities.

## VEGETATION

### Plant Communities

Vegetation in the park is a complex mosaic of seral, subclimax, and climax plant communities. Plant community composition is controlled by nutrient availability, moisture regime, and time since the last disturbance (Kurmish et al. 1978, 1979, 1980). In only short distances, differences in elevation and exposure can result in major changes in the vegetation community (see Schematic Representation of Vegetation Communities).

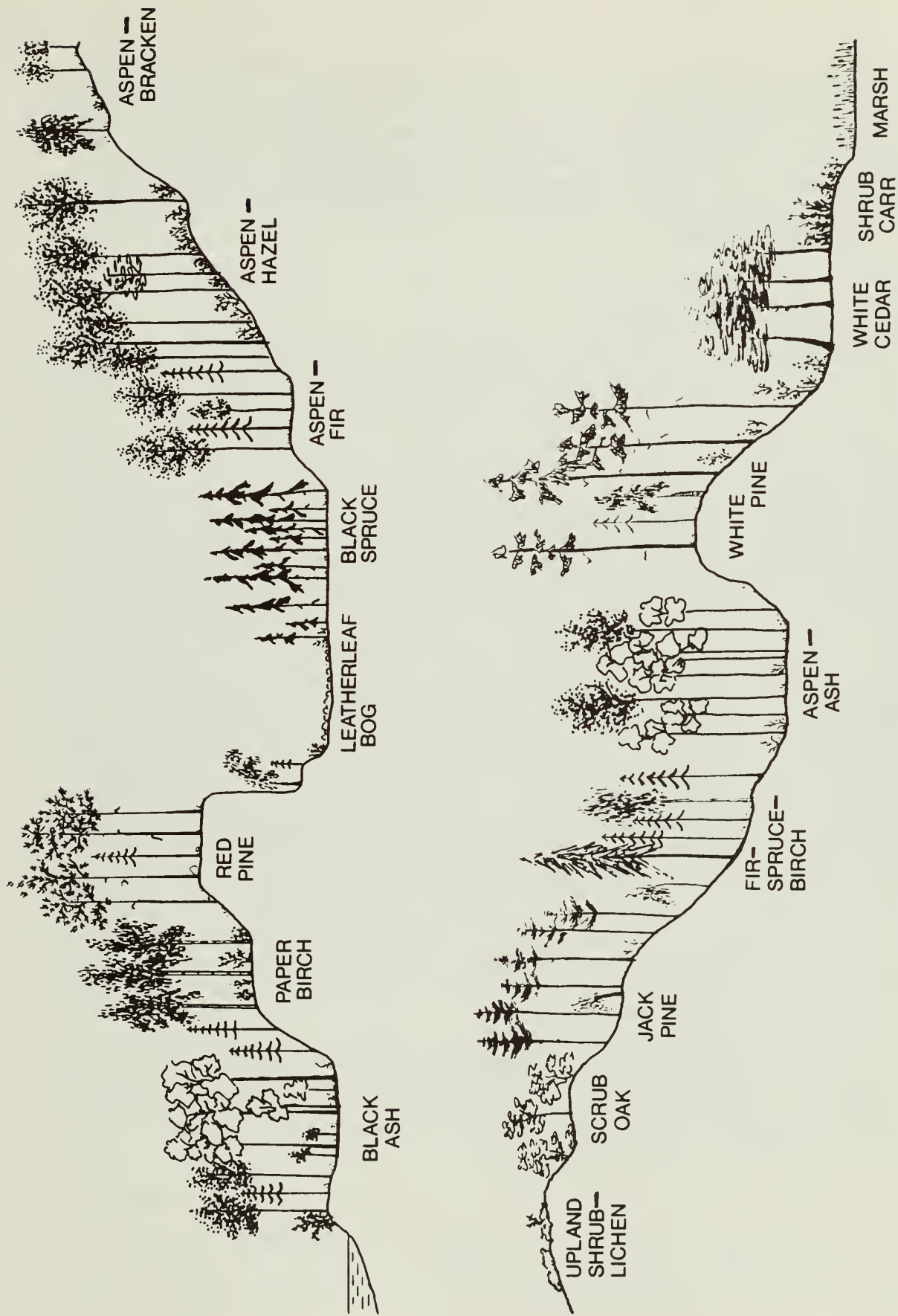
The park's vegetation communities represent a transition between boreal conifer forests to the north, mixed-hardwood forests to the south and southeast, and Great Plains forests to the west and southwest. Boreal forest species (such as jack pine, black and white spruce, trembling aspen, and paper birch) occupy about 70 percent of the park's total land area. Leatherleaf, Labrador tea, sphagnum, and a dozen or so other hardy northern species are widespread in the understory.

Mixed-forest species (such as red and white pine and balsam fir) are restricted to south-facing slopes, rocky ridgetops, lakeshores, and islands. Other species of minor occurrence include yellow birch, white elm, red and silver maple, and green ash. Characteristic shrubs and herbs of this southern association include hawthorn, poison ivy, stinging nettle, bittersweet, jack-in-the-pulpit, and blunt-lobed hepatica.

Vegetation representative of the Great Plains includes basswood, red oak, and bur oak/aspen. These species favor warm, dry sites, and they often grow on rocky outcrops along lakeshores or near the tops of south-facing slopes. Shrubs and herbs belonging to this western association include smooth sumac, alum root, freshwater cordgrass, and prickly pear cactus.

Several Voyageurs plant communities are uncommon either because they are outside their normal range, because they usually occur under different ecological conditions, or because they harbor rare plant species. These communities include black spruce, American basswood and ironwood, green ash/elm, black ash/fern/sedge, and white cedar/tamarack.

No plants federally listed as threatened or endangered are known to occur in the park. As of June 1986, Minnesota had listed two endangered species--the American shore-plantain (Littorella americana) and awlwort (Subularia aquatica), and one threatened species--a variety of sedge (Carex sterilis) (see Monson 1986). Several plants listed as species of



SCHEMATIC REPRESENTATION OF PLANT COMMUNITIES IN VOYAGEURS NATIONAL PARK  
 Source: Vilis Kurmis, et al., "Primary Plant Communities; Voyageurs National Park, Minnesota" (1980).

special concern by the state do occur in the park; most of these are rare in Minnesota because they are on the edge of their geographic range. Two plant species that occur in the park are under review by the Fish and Wildlife Service for listing as federal threatened or endangered species--the New England violet (Viola novae-angliae) and a variety of Oregon woodsia (Woodsia oregana var. cathcartiana). Both of these are category 2 species, which means listing is probably appropriate, but more information is needed.

### Changes in Plant Communities

Over the past 100 years the park's plant communities have changed significantly. Around the turn of the century the region's forests were a mosaic of different successional stages (Coffman et al. 1980). This situation resulted from thousands of years of lightning fires as well as aboriginal burning (Potzger 1953; Swain 1973, 1981). In the 1890s logging began in the pine and spruce forests, removing not only much of the red and white pine, spruce, and fir, but also the seed sources for these species. Forest communities were further altered by a series of human-caused fires, which were fueled by timber slash and occurred more frequently than lightning-caused fires. The gradual removal of mature forests as a result of both logging and fires stimulated aspen and birch growth, a change in forest species composition that is still evident today.

Other factors that affected the park's plant communities were fire suppression, which was adopted in the 1930s, and the termination of logging in 1971 when the park was authorized. The result of these factors has been additional changes in the composition of plant communities. The lack of disturbance by fire or logging has allowed existing aspen/birch communities to mature. This has subsequently reduced aspen/birch regeneration and at the same time prevented the establishment of new pine stands, which require seedbeds of fire-created, bare mineral soil for successful regeneration. Without the stimulation of fire, aspen, birch, and pine are being replaced by species intolerant to fire (such as fir/spruce forests on dry sites and ash/elm on moist sites).

The park's other plant communities have been less affected by logging and fires. Slowly evolving muskegs and marshes, as well as conifer swamps on wet sites and pine forests on dry rocky sites, still retain much of their original character.

The approved Wildland Fire Management Plan for Voyageurs will return fire to the park ecosystem under carefully monitored and controlled conditions. This will greatly aid regeneration of pine stands, and it will also stimulate the regeneration of aspen and birch stands. Related effects on wildlife are discussed below.

## FISH AND WILDLIFE

Voyageurs has a broad cross section of wildlife, including 48 species of fish, 16 species of amphibians and reptiles, over 240 species of birds, and 42 species of mammals. The sections below focus on species that could be affected by the construction and use of winter or summer trails. Of particular concern are the threatened bald eagle (Haliaeetus leucocephalus) and the threatened gray wolf (Canis lupus). In accordance with section 7 of the Endangered Species Act of 1973, as amended, this document will serve as a biological assessment for these species (see appendix C). Other species that could be affected include ungulates (which also serve as prey for the gray wolf) and various fish, birds, and small mammals. The osprey is listed as a species of special concern by Minnesota, but the population in Voyageurs appears to be healthy, and it would not be affected by trail development.

### Fish

The lakes in Voyageurs support a fishery resource that is a vital link in the ecological food chain of the area. Fish provide food for much of the park's wildlife. Osprey, bald eagles, loons, otters, bears, and other birds and mammals scavenge or prey on fish. Sportfishing has been and continues to be the principal visitor activity in the park. Walleye, smallmouth bass, perch, sauger, lake trout, northern pike, and muskellunge are the main sportfishing species.

Evidence of segregation of species into discrete local populations exists in the park's interior lakes on the Kabetogama Peninsula. The Shoepack Lakes support a strain of muskellunge that is genetically unique. Cruiser, Little Trout, and Mukooda lakes support small populations of lake trout, a species not found in the other interior lakes. Stocking of nonnative genotypes of lake trout into these lakes has made it difficult to assess the present condition of the native trout population. The interior lakes are not highly productive fisheries, and there is potential for overexploitation by sportfishing. As examples, without artificial stocking Cruiser Lake is estimated to produce approximately 51 pounds of lake trout per year, and Little Trout Lake approximately 106 pounds per year.

Elevated levels of mercury have been found in the tissues of fish taken from park and adjacent waters. The effects of these elevated levels on fish and fish consumers, such as bald eagles, ospreys, and river otters, are unknown. The Minnesota Department of Health and the Ontario Ministries of Environment and Natural Resources have published fish consumption guidelines, and warnings to fishermen will be posted at launch areas.

### Bald Eagles

The bald eagle is classified as a threatened species in Minnesota under the Endangered Species Act of 1973. The Northern States Bald Eagle Recovery Plan was prepared by an interagency recovery team in 1983.



The recovery plan describes programs for monitoring population trends and habitat; determining population and habitat needed to achieve recovery goals; managing populations to increase reproduction and reduce mortality; and increasing communication among agencies with management responsibility for eagles. Unlike the Recovery Plan for the Eastern Timber Wolf, the bald eagle plan does not recommend management zones for the eagle. The park's resource management program complies with and helps implement the objectives of the recovery plan in Voyageurs.

Bald eagles nest regularly throughout the park and depend on fish or ungulate carrion for a major part of their diet. The eagles arrive in late February, and until the ice on lakes and streams melts (late April or early May), they scavenge on the remains of wolf kills or other carrion. After the ice melts, they are dependent on fish and waterfowl.

The park has supported 13 to 21 breeding pairs since annual surveys began in 1973, with from 0 to 17 young fledged annually (NPS 1987b). There are approximately 250 breeding pairs in the state of Minnesota (Northern States Bald Eagle Recovery Team 1983). The park's bald eagle productivity levels are consistently lower than for populations in adjacent breeding areas or in other Great Lakes states. Most breeding sites in the park have been consistently occupied since 1973, but 70 percent of the time incubation has not been completed or the young have not been fledged. Compared to nearby breeding areas, park eagles are only half as productive; however, park ospreys are slightly more productive (NPS 1987b). The cause of low productivity in bald eagles has not been determined. It may be due to many factors such as lower fishery productivity, less discarded rough fish available to scavenging eagles because of declining commercial fishing, disturbance from late winter snowmobiling and early summer boating traffic, less late winter carrion due to depressed park ungulate populations, or mercury contamination in fish.

The most critical period for disturbance extends from the courtship period in early March through the incubation period in mid May. Surveys of park eagle nesting territories show 95 percent of the park's bald eagle nests are on a shoreline or within 0.1 mile of a shoreline. This means eagle nesting areas are susceptible to disturbance from snowmobile traffic in late winter and from boating traffic during summer. Heavy boating traffic begins on the opening of fishing season around May 15. Disturbance to several eagle nests by late season snowmobilers is possible because of the proximity of portages to nests. Summer boating parties have been observed beached or camped directly under eagle nests. Existing park policy closes campsites and water approaches in the vicinity of active eagle nests.

Eagle tolerance of human presence is highly variable, both seasonally and among individual eagles. Some eagles nest and accept people who are very close, while other eagles are very intolerant of human presence and fly away if anyone is within 0.25 mile. Disturbance to eagles has been observed but not systematically studied. Disturbance could be disrupting courtship activities and causing adults to fly from nests and leave eggs exposed during incubation.



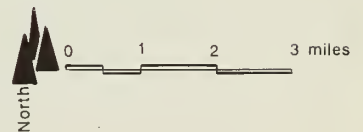
○ BALD EAGLE TERRITORY

/// MOOSE WINTERING AREA

■■■■ WOLF PACK TERRITORY (INDEFINITE)

Note: White-tailed deer are widely distributed throughout park.

172/40042B JULY 1988

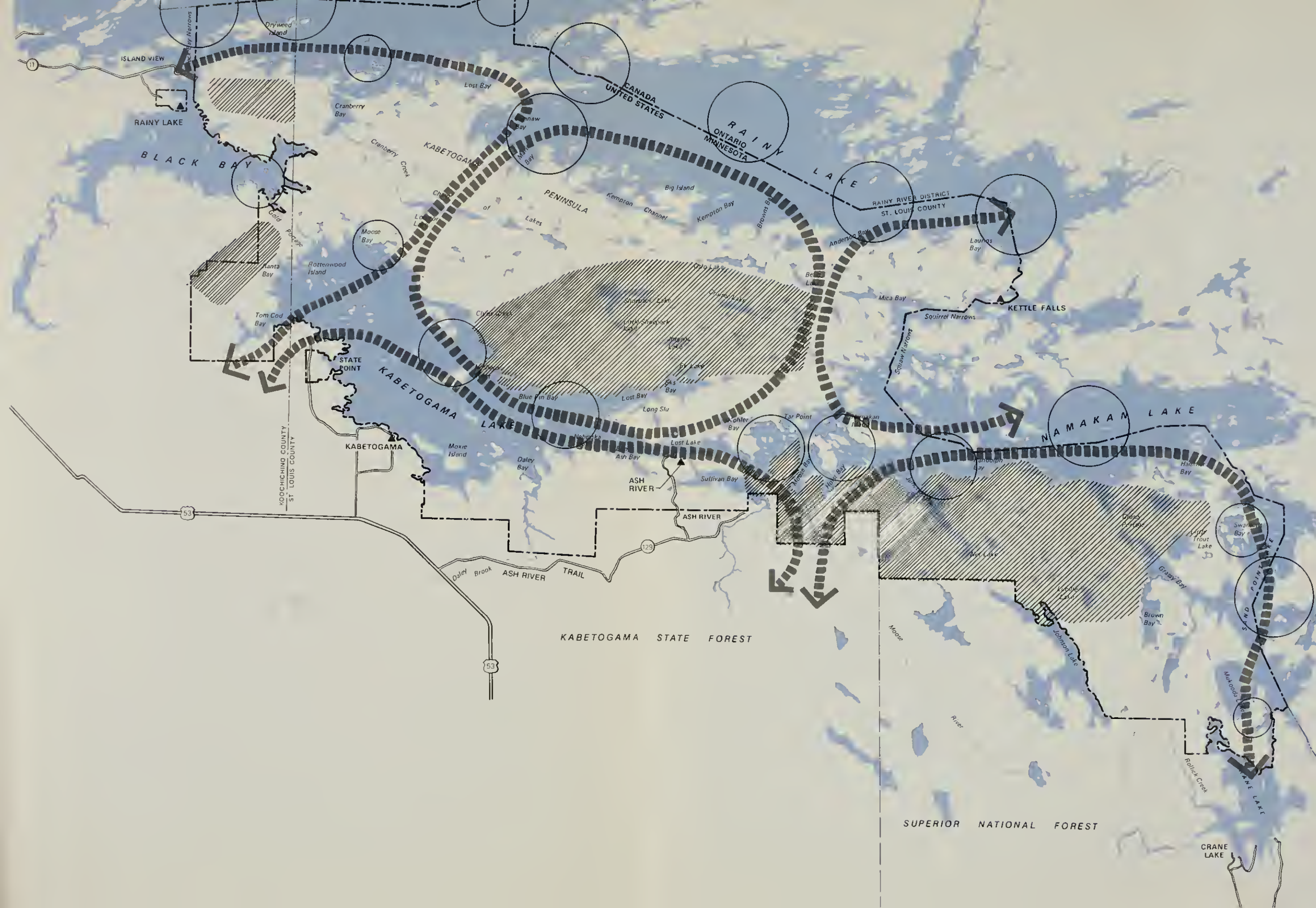


## WILDLIFE

### voyageurs national park

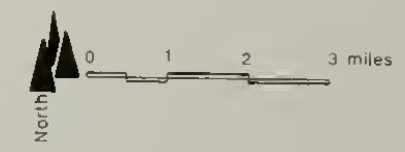
U.S. Department of the Interior / National Park Service





- BALD EAGLE TERRITORY
  - ▨ MOOSE WINTERING AREA
  - ▬▬▬ WOLF PACK TERRITORY (INDEFINITE)
- Note: White-tailed deer are widely distributed throughout park.

172/40042B JULY 1988



Ospreys typically nest in forested areas 0.25 mile from shorelines, thereby having greater protection from human disturbance. This may explain why eagle nesting productivity is down but osprey productivity is not. The situation is complex, and scientific research will be necessary to understand the problem.

The effect on eagles of mercury found in the tissue of fish, which is then concentrated by fish eaters such as eagles, is not understood. Eggs from park birds are being analyzed to determine if contamination may be a factor in lowering reproductive success.

### Loons

The common loon, Minnesota's state bird, is listed by the Department of Natural Resources as a species of special concern. Loons are found throughout the park on the large lakes and interior lakes of the Kabetogama Peninsula, where they nest on small islands or floating bogs and use quiet backwaters with emergent vegetation to rear their broods. Loons are very sensitive to recreational disturbance from nearby boaters, campers, and fishermen during the nesting season. Disturbance causes them to leave their nests during egg incubation and when they are rearing their young. Loon-nesting productivity is relatively good on the interior lakes, but it is affected by unnatural water fluctuations in Namakan Reservoir. A public education program has been begun to help protect nesting areas, and warning signs are posted near such areas. Also lakeshore and backcountry campsites are being located away from nesting areas.

### Gray Wolves

Originally, gray wolves (also known as eastern timber wolves) occupied most of the contiguous eastern United States and southeastern Canada. At present, the eastern U.S. population is concentrated in Minnesota, Michigan, and Wisconsin, an area that comprises only about 3 percent of the wolf's former range (see Gray Wolf Range in Northern Minnesota map). There is no information about how many wolf packs inhabited the region before the park was established.

In 1967 the wolf was listed as endangered by the U.S. Department of the Interior. In 1970 Superior National Forest (a portion of which was included in Voyageurs National Park in 1971) was closed to the taking of wolves. In August 1974 the gray wolf was listed by the U.S. Fish and Wildlife Service as threatened in Minnesota under the Endangered Species Act of 1973, and the state of Minnesota also subsequently classified it as a threatened species.

The variability and dynamic nature of wolf densities throughout northern Minnesota make it difficult to accurately estimate current numbers of wolves. In determining the status of the population in the Voyageurs region, there may be parallels with the wolf population in Superior



National Forest. An estimated 400 wolves inhabited the national forest in the winter of 1971-72, or one wolf per 10 square miles (Mech 1973). Beginning with a series of severe winters in the late 1960s, a sharp decline in the deer population occurred between 1968 and 1977, and then stabilized (Nelson and Mech 1986). A combination of severe weather, poor forage conditions, and wolf predation apparently caused the decline of deer. By 1974-75 the wolf population had declined 40 percent, to one wolf per 17 square miles. Wolves preyed on alternative species, such as beaver and moose, during the deer decline (Mech and Karns 1978).

Limited data from overflight counts and some field research suggest that the wolf population using Voyageurs National Park and adjacent lands declined approximately 40 percent between 1977 and 1985, from an estimated 40 individuals to 25. This decline could have been due to a 50 percent reduction in the number of overwintering white-tailed deer in the park and vicinity (NPS 1987b). Initially, single animals or pairs disappeared, but eventually the number of packs decreased from seven to five. Only one of the five wolf packs now using the park is thought to range entirely within the park boundary. Wolves are highly mobile and may well spend much of their time outside the park searching for food.

As an endangered species, the wolf is legally protected in Isle Royale National Park, Boundary Waters Canoe Area Wilderness, and Superior National Forest, as well as Voyageurs. Wolves that venture onto adjacent lands in Ontario may be legally shot or trapped; however, Quetico Provincial Park is closed to motorized access, which affords some protection to wolves. Wolves on nonpark lands in Minnesota are subject to limited control actions, vehicular road-kills, accidental trapping, and illegal hunting and trapping; however, Boundary Waters Canoe Area Wilderness is closed to motorized access. Portions of Superior National Forest are managed for timber harvest and wildlife habitat improvement, which would benefit wolf prey species.

Three main factors are critical to the survival of the wolf: (1) availability of adequate wild prey, (2) large tracts of land with low human densities, and (3) ecologically sound management. Programs to address each of these factors are described below.

- (1) Adequate Prey--Two programs are being proposed in Voyageurs to increase prey availability for wolves and other predators and scavengers--the fire management plan and the reintroduction of wildlife species that previously inhabited the region. The objective of fire management is to reinstate presettlement forest conditions of fire-dependent and early successional stages of plant communities in order to increase the park's capacity to support larger deer and moose populations. The proposal to restore woodland caribou and elk populations is also expected to increase the numbers of prey animals for wolves. All factors combined would help return the park ecosystem to conditions more representative of presettlement conditions.



*s i n*

# GRAY WOLF RANGE IN NORTHERN MINNESOTA **voyageurs national park**

U.S. Department of the Interior / National Park Service



Note: Wolf recovery plan zones based on the *Recovery Plan for the Eastern Timber Wolf* (Eastern Timber Wolf Recovery Team 1981)

## GRAY WOLF RANGE IN NORTHERN MINNESOTA voyageurs national park

U.S. Department of the Interior / National Park Service



The Boundary Waters Canoe Area Wilderness is also managed to let lightning-caused fires burn under managed conditions, which would improve wildlife habitat for deer and moose, thus enhancing available prey species for wolves and scavengers. Lightning fires are still suppressed in Quetico Provincial Park. Timber harvest in Superior National Forest is used as a wildlife habitat management tool.

- (2) Large Areas with Minimal Human Disturbance--Historically wolves had access to large tracts of land with low human density and few roads. With increased human settlement and road construction, wolf habitat and populations were significantly reduced. If present road-building trends continue outside the park, prime wolf habitat in northern Minnesota and southwestern Ontario could be restricted to roadless areas in and around Voyageurs National Park, the Boundary Waters Canoe Area Wilderness, and Quetico Provincial Park.

Research has shown elsewhere that as road density exceeds 0.93 mile of road per square mile of potential wolf habitat, wolves cannot survive (Thiel 1985). In 1987 the average road density in Minnesota's primary wolf range (see Gray Wolf Range in Northern Minnesota map) was 0.34 mile of road per square mile (Mech et al. 1987). As human access into wolf habitat increases, wolf numbers are reduced by legal and illegal trapping and hunting, predator control actions, accidental road-kills, and intentional harassment by snowmobilers and other all-terrain vehicle users. Consequently, the construction of more roads adjacent to the park in Minnesota and Ontario will increase outside influences on the gray wolf population.

Research at Voyageurs and Isle Royale national parks shows that lakeshores are important areas for wolves, which hunt and travel within these shoreline corridors. Snowmobilers disrupt the movement and feeding of wolves along these shorelines.

In some cases human activity excludes wolves from suitable habitat. At Isle Royale National Park wolves began to avoid trails when spring visitor use increased (Peterson 1977). Most wolves avoided establishing denning sites within 0.5 mile of a trail. Trail and campsite development deterred wolves from using some rendezvous sites. Following repeated human disturbance, wolves may move pups away from homesites, thus exposing them to undue danger (Chapman 1979).

A related problem of human concentrations near wolf habitat is the spread of parasites and diseases carried by pets to wild canids, including the wolf population. This is especially true of heartworm (Dirofilaria immitis) and canine parvovirus, both of which are relatively new diseases to the gray wolf and other native canines. Heartworm has spread northward into wolf range probably by means of southern dogs being brought into



the area. Parvovirus is currently infecting Minnesota wolves and can be fatal (Mech et al. 1986). It was implicated in a recent decline of wolves at Isle Royale National Park (Peterson 1985). Mange (Sarcoptes scabiei), a widespread ectoparasite, has been observed in area wolves and could be an important factor in wolf mortality either directly through exposure to cold temperatures, or indirectly by weakening the host and increasing its susceptibility to disease (Carbyn 1983). It is conceivable that these diseases or parasites could have adverse impacts on wolves at Voyageurs.

A no-pets policy has been strictly enforced at Isle Royale National Park since 1980 to protect the park's wolves and foxes from parasites and diseases. Dogs pose a special threat, and even if they are confined to households and buildings, disease organisms can be transmitted to wild canids by means of feces and airborne hosts such as insects. Regulations at Voyageurs prohibit pets on trails; however, pets are allowed at campsites and along shorelines. The adoption of a no-pets policy at Voyageurs may not be as effective as at Isle Royale because wolves and foxes would continually interact with infected pets when outside the park. Some restrictions, however, may be effective in minimizing contacts between infected pets and uninfected park wolves and foxes.

- (3) Ecologically Sound Management--Ecologically sound management for the wolf population is the objective of the eastern timber wolf recovery program. Under the program four wolf management zones have been established for portions of Minnesota occupied by wolves; the rest of the state outside occupied wolf range is designated zone 5 (see Gray Wolf Range in Northern Minnesota map).

Zones 1, 2, and 3 comprise the primary range of the wolf in Minnesota; these zones have low human population densities and little domestic livestock industry, and they are largely forest or swamp country. Zone 1 encompasses Voyageurs National Park, the Boundary Waters Canoe Area Wilderness, and portions of Superior National Forest and other public lands. The management goal in this zone is to allow the wolf population to naturally fluctuate without population management. Zone 2 lies south of zone 1 and consists of Superior National Forest, other public land, and some private land. Zone 3 lies southwest of International Falls. The rest of Minnesota that has occupied wolf range is classified as zone 4 and includes privately owned farm and residential land.

In all zones if wolves have been documented in domestic animal depredations, they may be removed by authorized government personnel. In zones 2 and 3, wolf populations may be controlled to help manage prey (large deer) populations. Habitat manipulation through cutting or burning is encouraged

to support higher prey populations. Even though the recovery program does not contemplate prey or habitat management in the park, options for such management actions will not be precluded.

### Ungulate Populations

White-tailed deer and moose are among Voyageurs' principal wildlife attractions. Dense thickets of young aspen and birch, hazel, raspberry, willow, mountain maple, and mountain ash provide habitat for these animals. Both species prefer recently burned areas and deciduous-dominated communities in early winter and conifer-dominated stands, especially those containing balsam fir and white cedar, in late winter. Parkwide there are an estimated 800 deer and 40 moose.

Woodland caribou and elk were also once part of the Voyageurs ecosystem. From the late 1890s to the 1920s caribou, elk, moose, and white-tailed deer were hunted for food for the region's first towns, logging camps, and homesteads. Caribou and elk were both eliminated from the park area by hunting, and the size of the moose population was severely reduced. As competition from these ungulates decreased, and as logging and fires improved browse conditions, white-tailed deer increased and reached peak densities by the 1930s. When the fire suppression policy was introduced in the 1930s, one of the results was a maturing forest that by the 1950s had grown beyond the reach of deer and moose, and deer numbers gradually declined. The park's maturing forests have also severely limited the availability of critical winter habitat for white-tailed deer and moose (Irwin 1975). More rapid declines in the deer population occurred after 1975 when the park was established and logging was stopped, and this decline may have been caused by periodic severe winters, forest succession, and increased wolf predation. The reduced moose population may be because of poor food sources and inbreeding (Cole, personal communication 1987).

The elimination of caribou and elk, the low moose population, and the recent dramatic decline in white-tailed deer numbers have resulted in an estimated 66 percent reduction in the park's pre-1890 overwinter ungulate biomass (Cole 1982, 1987).

The reestablishment of viable populations of woodland caribou and elk will be attempted to help restore a historically authentic southern boreal forest ecosystem. Reestablishing these species, if successful, would also provide a larger and more diverse prey base for the threatened gray wolf and other park carnivores and scavengers.

### Other Mammals

The severely limited overwinter food supply for ungulates in the park has also caused a reduction in the park's other predator and scavenger populations. Predators and scavengers that were once abundant are now

either absent (wolverine), exist in remnant numbers (Canada lynx, bobcat), or are less abundant than they used to be (coyote, red fox, pine marten, and raven). (See Cole 1982, 1987; Mech 1973; Van Ballenberghe, Erickson, and Byman 1975; Peterson 1976; Hardwig 1978; Mech and Karns 1978.)

Beaver are abundant, and they serve as alternative prey species in lieu of deer. An estimated 3,000 beaver inhabit the park. In contrast, porcupines were very common up to the 1950s but were extremely rare by the 1970s, probably because the timber industry tried to control them as a pest species. Porcupines were reintroduced in the park on islands in Kabetogama Lake in 1983 and 1984.

Black bears are well-adapted to the park's forests, bogs, and marshes. Primarily omnivores, black bears occasionally eat artificial food gleaned from campsites, dumpsters, and cabin sites in and around the park. An estimated 200 bears inhabit the park. The park has instituted a bear management program.

### Insects

The numerous wetlands, ponds, and moist forest conditions found in Voyageurs provide a great hatchery for black flies, mosquitoes, and other biting insects. The density of insects discourages hiking and camping in forests between early June and mid-August. This has strongly influenced recreational patterns, encouraging visitors to boat on the larger lakes and to either camp on breezy points or stay in resorts to avoid insects during early summer.

### AIR QUALITY

Air quality and air-related values such as visibility are relatively high at Voyageurs, and clean air is recognized as one of the park's natural resources. Under the provisions of the Clean Air Act of 1977, Voyageurs was designated a class I area in 1979. This designation sets limits on the amount of allowable pollution.

Air quality at Voyageurs is affected by local industrial sources at International Falls/Fort Frances, and by widespread emissions from settlement and industrial sources of northern Minnesota, the industrialized Midwestern states, southwestern Ontario, and southern Manitoba.

Air quality monitoring in the park has been underway since the early 1980s. Levels of acid precipitation, sulfur dioxide, ozone, heavy metals, suspended particulates, and aerosols are recorded, along with effects on vegetation. The average annual pH value of precipitation at the Black Bay air quality monitoring station is 4.9, which is slightly acidic. Based on the best available evidence, the current acid deposition rate is not sufficient to negatively affect aquatic or terrestrial ecosystems. If the trend continues, however, impacts on ecosystems will become detectable (NPS 1987b).

## WATER RESOURCES

Voyageurs National Park, as previously mentioned, is dominated by four major lakes--Rainy, Kabetogama, Namakan, and Sand Point--with numerous smaller fingerlike lakes and unnamed ponds and bogs. The construction of dams at International Falls and Kettle Falls after the turn of the century changed the lakes into reservoirs with fluctuating water levels. Normal pool elevation for the Rainy Lake reservoir is 1,108 feet above mean sea level. Normal pool elevation for the Namakan reservoir, which includes Kabetogama, Namakan, and Sand Point lakes, is 1,118 feet above mean sea level. Water levels of the border lakes are regulated by the International Joint Commission--United States and Canada.

Water quality in the park area is generally good, although some acid precipitation has been recorded. The buffering capability of the underlying soil and bedrock is poor, making the area susceptible to greater acidification. Elevated levels of mercury, possibly as a result of acid precipitation, have been found in body tissues of park and regional fish and wildlife that are at the top of the food chain, such as walleye, bald eagles, osprey, and river otter. Acid precipitation is known to mobilize trace metals contained in soil and rock (NPS 1987b).

Groundwater resources are limited because of shallow soils and bedrock.

## CLIMATE

The climate of the Voyageurs region is primarily influenced by cool polar air from the north and warmer, drier continental air from the west. Temperatures during the short summer normally do not exceed 90 degrees Fahrenheit. The average frost free period is 72 days. Winter temperatures frequently fall below zero for extended periods, and temperatures in the -30° to -40° F range are not uncommon.

Average annual precipitation is about 28 inches, with two-thirds falling as rain between May and September. Typical annual snowfall is around 60 inches, and the snowpack lasts from November through April or early May. The earliest and latest ice-out dates for Kabetogama Lake are April 17 and May 14, and for Rainy Lake, April 18 and May 22.

Winds average 15 miles per hour during most months, but speeds up to 50 miles per hour occur on the major lakes. Prevailing winds in spring and summer are from the southwest and in winter from the northwest.

Every five to 10 years on the large lakes, and more frequently on the smaller, sheltered lakes, weather conditions cause slush-ice to form, resulting in hazardous winter travel. Several weather patterns can cause slush, which may last for several weeks or all season. During warmer winters with continued heavy snowfall during the December freeze-up, the insulating quality of snow prevents the formation of hard, solid ice, resulting in weak, slushy ice beneath the snowpack.



Under other conditions heavy snowfall during midwinter may crack even thick ice, allowing water to rise up and flood the ice surface beneath the snowpack. In this situation the ice layer may be strong enough to bear heavy loads, but a slush layer lies on the surface of the ice hidden beneath the snow cover. In either case, the insulating quality of the surface snow layer may prevent solid freezing of the slush for several weeks or months. The surface snow may also conceal the underlying slush. Snowmobiles may unexpectedly run into slush areas and become stuck. The rider may then get wet feet in trying to extricate the machine. This can be a very hazardous situation, especially if feet become frozen or the machine is lost. Skiers are not as vulnerable to slush-ice conditions because they do not sink as deeply as a snowmobile and they can turn around before getting stuck or wet.



## CULTURAL RESOURCES

Voyageurs National Park contains a variety of cultural resources identified with the prehistoric Archaic and Woodland cultures, early French explorers, the fur-trading voyageurs, and turn-of-the-century loggers, miners, commercial fishermen, and resort operators.

Archeological studies have been conducted in the park by the Minnesota State Historical Society, the University of Minnesota, and the National Park Service's Midwest Archeological Center. No systematic survey of the park for archeological sites has been made; however, most of the shorelines of the major lakes and to some extent developed areas have been surveyed. Very little survey work has been done on interior areas. Existing trail corridors have not been surveyed. It is anticipated that few sites would be found along trails because most prehistoric human activity in this region occurred along the shorelines of major lakes.

At least seven archeological sites are considered potential candidates for nomination to the National Register of Historic Places. Evaluation of other sites by personnel from the Midwest Archeological Center is currently underway. Most sites are partially submerged because dams at Kettle Falls and outside the park at Squirrel Falls and International Falls/Fort Frances have raised lake levels above prehistoric and historic levels. The elevated lake levels, combined with fluctuations in the levels, have accelerated shoreline erosion in many areas of the park. This erosion threatens the integrity of many known and potentially unknown archeological sites.

An inventory of historic structures within the park was completed in 1975, and 21 sites were placed on the List of Classified Structures. Additional structures will be added upon completion of a historic sites survey. An inventory of historic sites must still be completed in accordance with Executive Order 11593. The Kettle Falls Hotel, Little American Gold Mine, the Kettle Falls Historic District, and the Gold Mine Historic District have been placed on the National Register of Historic Places. Other sites potentially eligible for inclusion on the National Register include several archeological sites that have maintained their integrity and are regionally significant for archeological research; Rainy Lake City, the site of an old mining town (which has been nominated but not yet accepted); Hoist Bay, the site of a historic logging operation; and the U.S./Canada boundary, which was surveyed by the American Joseph Delafield and the Englishman David Thompson.

## SOCIOECONOMIC ENVIRONMENT

### POPULATION

Voyageurs National Park is in Koochiching and St. Louis counties in northern Minnesota's Arrowhead region. The population of the two-county region was 237,824 in 1970 and 239,800 in 1980. In 1980, 93 percent of the population lived in St. Louis County, which contains the Duluth metropolitan area (population 117,000) and the Iron Range communities of Chisholm, Hibbing, and Virginia (combined population 39,200). Koochiching County is much smaller (population 17,600) than St. Louis County and includes International Falls, South International Falls, and several small adjacent communities (combined population 9,800). Since 1980 the population has decreased slowly. Emigration probably increased dramatically after the sudden downturn in employment in late 1984.

The 1980 average population density of 6.75 persons/square mile of land area is indicative of the area's rural, northwoods character. In contrast to the projected 7.2 percent increase in population statewide by 1990, the population in these counties is projected to decrease by 4 percent.

### REGIONAL ECONOMY

The regional economy is dominated by mining and mineral activities associated with the Mesabi Iron Range. Timber and wood products are second, but they are not nearly as important to the region as mining. If developed, copper, nickel, or gold deposits within the region would further increase the economic importance of mining.

#### Logging Industry

Economic activity around the park is largely related to wood products, and the Boise Cascade Corporation is the major employer. In December 1984 Boise Cascade closed one of its two manufacturing plants in International Falls. This resulted in the loss of about 500 jobs and severe economic hardship for the community. In 1987 another firm opened a mill to manufacture the same fiberboard product, and this has partially offset the loss of the Boise Cascade plant. In spring 1988 Boise Cascade announced a \$525 million expansion of its wood products plant, which would replace the jobs lost during its 1984 closing.

The wood products industry contributed over half of the wages paid in Koochiching County during 1978. Government employment accounted for another 20 percent. All remaining sectors contributed just over a quarter of the total wages paid in the county.

## Tourism

The resort communities surrounding Voyageurs National Park--Island View, Kabetogama, Ash River, and Crane Lake--differ markedly from International Falls in their economic base. These communities rely almost completely on tourism. The 60 individual resorts in these communities provide lodging, food, and recreational services. During the summer houseboats can be rented and fishing supplies purchased. Winter visitors can buy or rent snowmobiles and skis. Repair services are also available.

These resort communities are currently undergoing economic difficulties. Present trends show a decline in small hotel/motel accommodations. Increasing operating costs are making it difficult for smaller owners to realize enough profit to upgrade facilities, thus decreasing the desirability of these accommodations to some potential visitors. These resorts offer traditional recreational opportunities centered around fishing and to some extent hunting outside the park, but the overall demand for this type of experience appears to be declining. New visitors to the Voyageurs area are less interested in just fishing and hunting and increasingly prefer additional activities. In the opinion of the park staff, this trend is due primarily to changing visitor origins and preferences in accommodations. Area resorts are trying to adjust to this new market, which has been caused in part by the establishment of the park and the Boundary Waters Canoe Area Wilderness.

In cooperation with the park, the resort community has recently been engaging in a successful marketing effort, primarily by offering snowmobile tour packages. Part of the recent increase in area snowmobile use can be attributed to this marketing. Over the past five years a few resorts have started staying open in the winter.

The interdependency of public and private sectors in serving recreational needs has important economic implications. Public facilities (for example, the State Corridor snowmobile trail) are often designed to complement facilities provided by resorts (for example, lodging). The state is also helping finance improvements at resorts through the Iron Range Resources Rehabilitation Board.

The park currently has five concessioners. Two of these rent small boats, and two others operate tour boats. The fifth concessioner operates the Kettle Falls complex.

## VISITOR USE

### EXISTING RECREATIONAL ACTIVITIES

A wide variety of recreational activities are available in Koochiching and St. Louis counties, and they are provided by both public agencies and private enterprise. According to studies by the Minnesota Department of Natural Resources, the most popular summer activities in this region are fishing (21 million visitor hours), camping (11 million hours), canoeing (6 million hours), boating (3.5 million hours), hiking (3 million hours), and swimming (2.5 million hours; MDNR 1985a and b). Wilderness uses, predominantly canoeing, are provided in the 1.2-million-acre Boundary Waters Canoe Area Wilderness (administered by the U.S. Forest Service) and the 1.1-million-acre Quetico Provincial Park (administered by the Ontario Ministry of Natural Resources).

The most popular winter activities are snowmobiling and cross-country skiing. Approximately 165 miles of trails in Koochiching County are designated for snowmobile use and 4.5 miles for cross-country skiing. In St. Louis County 325 miles of trail are available for snowmobiling, 53 miles for hiking, and 49 miles for cross-country skiing (most of these trails are multiple use trails).

In Voyageurs National Park a total of approximately 54 miles of trail are currently available for visitor use. Hiking trails total 26 miles, but many trails are very short and also serve as canoe portages. Approximately 4.5 miles of snowmobile trails in the park near Daley Brook and Tom Cod Bay are maintained by a local snowmobile club using state funds. These trails are to be rerouted to areas outside the park in the near future. Most of the existing winter routes in Voyageurs existed before the park was established, and with the exception of safety portages, they have not been improved by the National Park Service since 1975.

Numerous opportunities are available in the region and immediately adjacent to the park for automobile, motorhome/trailer, motorboat, houseboat, and canoe camping in developed campgrounds. Backcountry campsites are also available, but they are more limited. There are about 110 developed campsites in the national park on the shores of the major lakes and in the backcountry. An additional 400 undeveloped sites are also regularly used by campers.

### VISITATION

About one-third of all summer tourist recreation in the state of Minnesota occurs at Voyageurs National Park, the Boundary Waters Canoe Area Wilderness, and adjacent areas (MDNR 1985a and 1985b). Out-of-state visitors account for 78 percent of the total tourist hours spent in this area, while Minnesota residents account for the remaining 22 percent. The majority of out-of-state tourists come from Illinois, Indiana, Ohio, and Michigan. Most of the in-state tourists come from the Twin Cities



area and the Arrowhead region. The heavy use by nonresidents indicates the high visibility of the area in out-of-state markets. During winter, however, only about 2 percent of the park's visitors are from out-of-state, 8 percent from Minnesota but outside the local area, and the other 90 percent from within 40 miles of the park.

Annual visitation at Voyageurs National Park in 1986 was approximately 37,000 visitors. The average visitor spends approximately five days in the park per trip, and return visits are likely (NPS 1984). The accompanying graphs convert the number of visitors into the number of monthly and annual visitor-days. Nearly all of the visits are for recreational purposes. Approximately 60 percent of the park visitors are day users who spend the night at local resorts or motels/hotels in nearby communities. The other 40 percent of the visitors are campers who stay in the park.

The most popular visitor months are May through September, when the largest variety of activities are offered. Snowmobiling and cross-country skiing account for most of the use increases in January and February.

### Recreation Expenditures

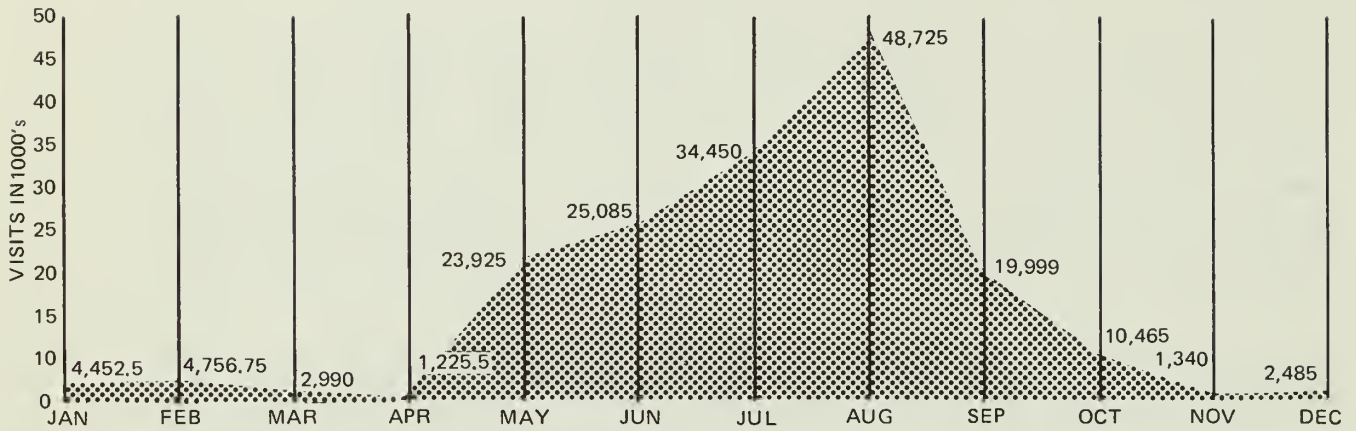
For the purposes of this plan, distinctions have been made between expenditures by local residents and by visitors who live outside the region, and between expenditures by winter visitors and summer visitors.

Nonlocal visitors necessarily spend more per day for lodging, restaurants, and other vacation-related expenses, and these expenditures constitute new dollars coming into the local economy. The following analysis focuses on winter recreational expenditures because winter trail development would directly affect the amount of these expenditures; summer trail development would probably not have a significant effect because hiking is secondary to fishing and boating, and visitors generally do not come to Voyageurs to hike.

The estimates of winter recreation expenditures shown in table 3 are based on studies of similar areas (a 1978-79 winter recreation survey in Wisconsin and an NPS-sponsored survey of West Yellowstone in 1978-79); a local economic survey has not been done. The survey results were examined and compared with the local situation, and figures were updated to 1985 by applying a 70 percent increase in the consumer price index. An estimate of the distribution of the direct expenditures was made to various business sectors--lodging, restaurant and tavern, groceries and beverages, gas, automobile expenses, and tourist goods. For snowmobilers machine rental and related expenses were considered as well (it was assumed that some but not all snowmobilers would rent machines). For these calculations it was also assumed that the average nonlocal visitor was a member of a party of three staying overnight three nights. The total expenditures are estimated for park visitors only. Users of nearby facilities are important to local resorts, but they are not necessarily park visitors.



**VISITOR-DAYS IN VOYAGEURS NATIONAL PARK – 1986**  
(Recreation and Nonrecreation Visits)



**VISITOR-DAYS IN VOYAGEURS NATIONAL PARK – 1976-1987**  
(Recreation and Nonrecreation Visits)

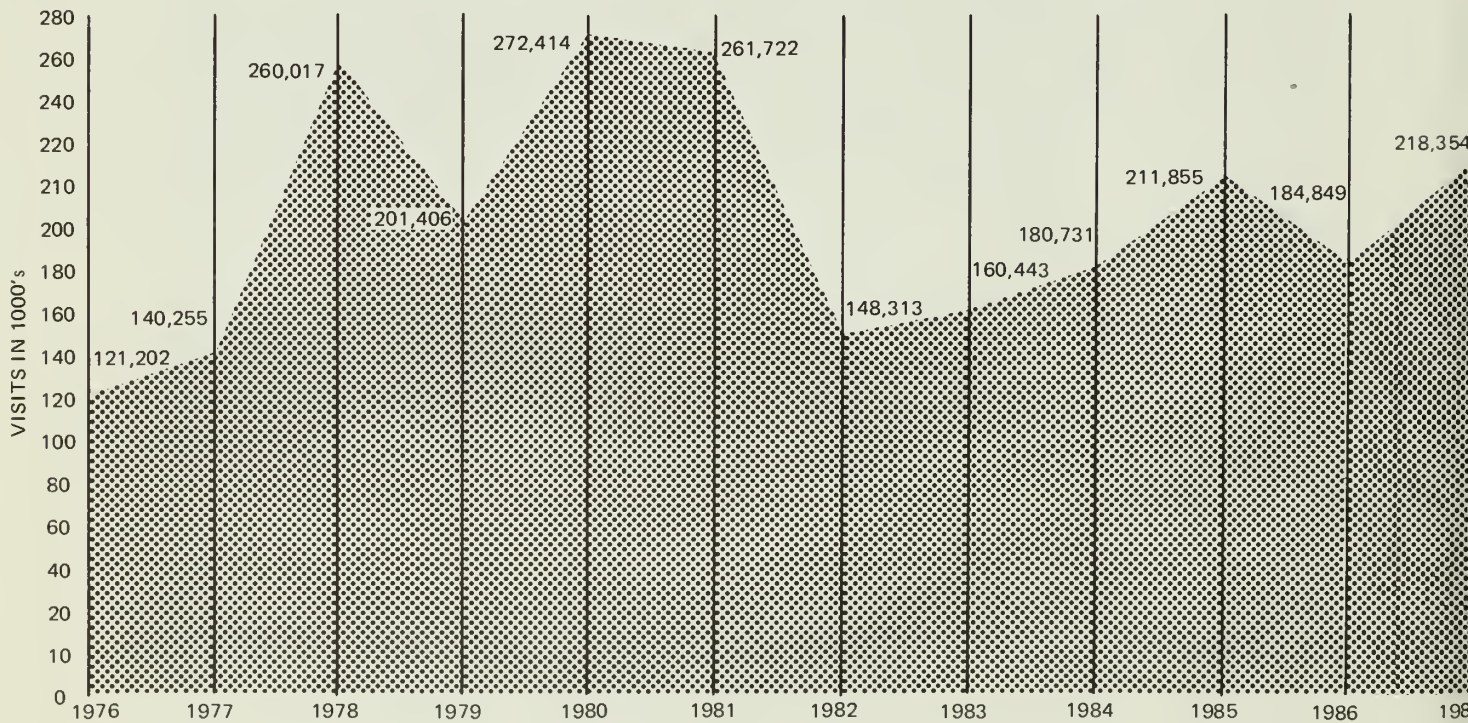


Table 3: Estimated 1985 Average Expenditures by  
Skiers and Snowmobilers in Voyageurs National Park  
(per person per day)

Expense	Daily Skier Expenditures			
	Local Skiers		Nonlocal Skiers	
	Percentage of Total	Dollar Amount	Percentage of Total	Dollar Amount
Lodging	-	-	45	\$18.00
Restaurant/Tavern	33	\$ 5.00	25	10.00
Groceries/Beverages	33	5.00	10	4.00
Gasoline	20	3.00	10	4.00
Other Automobile Related Costs	13	2.00	5	2.00
Tourist Goods	-	-	5	2.00
Total	100	\$15.00	100	\$40.00

Expense	Daily Snowmobiler Expenditures			
	Local Snowmobilers		Nonlocal Snowmobilers	
	Percentage of Total	Dollar Amount	Percentage of Total	Dollar Amount
Lodging	-	-	25	\$ 25.00
Restaurant/Tavern	10	\$ 2.50	20	20.00
Groceries/Beverages	30	7.50	10	10.00
Gasoline	50	12.50	15	15.00
Other Automobile Related Costs	-	-	10	10.00
Snowmobile Rental and Service	10	2.50	15	15.00
Other Tourist Goods	-	-	5	5.00
Total	100	\$25.00	100	\$100.00

Table 4: Estimated 1985 Expenditures by Winter Sports Participants  
at Voyageurs National Park

Visitor Group	Total Visits*	Daily Expenditure	Annual Expenditure	Total with Multiplier
Local skiers	4,100	\$ 15	\$ 61,500	\$123,000
Nonlocal skiers	500	40	20,000	40,000
Total	4,600		\$ 81,500	\$163,000
Local snowmobilers	9,000	\$ 25	\$225,000	\$450,000
Nonlocal snowmobilers	1,000	100	100,000	200,000
Total	10,000		\$325,000	\$650,000

\*Based on park monthly use reports.

Based on these surveys, it is estimated that skiers from the local region spend an average of \$15 per person per day, while nonlocal skiers spend an average of \$40 per person per day. Expenditures by snowmobilers are estimated at \$25 per day for each local resident and at \$100 per day for each nonlocal resident. Nonlocal expenditures are expected to increase, while local expenditures will probably remain level because it is assumed that those residents inclined to ski or snowmobile are already doing so and would continue to do so. No increases in local participation are foreseen as a result of the local economy.

The effect of any expenditures by nonlocal visitors within the economy is multiplied as this new money is respent or reinvested by local businesses, for example, increased advertising by a local motel. For this plan a doubling effect is projected, as shown in table 4.

### Visitor Use Projections and Trends

Visitor Projections. The Minnesota Department of Natural Resources has projected recreation visits to this area by activity. With few exceptions, little change has been projected for participation in most activities between 1978 and 1995. Total use is projected to increase by only a few percentage points over this 17-year period.

Park visitation of all types will probably continue to grow at a moderate rate (2 to 4 percent per year) throughout the 10-year life of this plan. However, aggressive marketing of recreational opportunities and services by the resorts could result in a significantly larger growth rate. Because of recent population and employment declines in the Voyageurs' area, local visitation to the park is not projected to increase.

Winter Recreation Trends. Snowmobile use was popular locally in the Voyageurs area before 1975, when the Boise Cascade Corporation managed timber production on the Kabetogama Peninsula. Since the park was established, snowmobiles have been allowed to use abandoned logging roads to reach interior lakes on the peninsula. Snowmobiling on the frozen surfaces of the major lakes has also been a traditional activity, and the safety portages that support this activity predate the establishment of the park.

Participation in all winter sports throughout the Arrowhead region has been increasing more rapidly than participation in summer activities. Snowmobile and cross-country ski trails are being extended, and resorts are beginning to cater to winter sports enthusiasts by providing more attractive accommodations and by marketing winter tour packages (including shuttle services). Many of these tour packages appeal to urban residents, and they attract a sizable repeat business. The most successful resorts tend to be closer to Lake Superior or to major metropolitan areas.

Based on the number of snowmobile registrations both in the region and statewide, the popularity of snowmobiling has declined since 1976. This trend is probably due to a declining interest in snowmobiles since the



early 1970s, steeply increasing prices of snowmobiles and gasoline, and the growing popularity of all-terrain, all-season vehicles, which cost less than half the price of snowmobiles (the use of three-wheelers is particularly popular among local teenagers). Statewide snowmobile use is projected to begin increasing again, but at a more modest rate than in the early 1970s. The Minnesota Department of Natural Resources projects that snowmobile use in the region will increase 14 percent by 1995; other authorities expect a somewhat lower rate of growth. The Minnesota DNR Trail Plan (1984) does not project any change in regional snowmobile use patterns by 1990, and the need for additional trails was generally not supported at a statewide level.

Several factors could counteract the trend of slower growth rates for snowmobile use. The development of new visitor facilities, both within the park and outside it, could increase visitation. For example, if the local resorts continued winterizing their facilities and offering tour packages, visitation to the area could increase at a more rapid rate. Also the experience of snowmobiling in a national park could attract more visitors. For the purposes of this plan, therefore, snowmobile use in the Voyageurs region is projected to continue increasing at a moderate rate in the near future, primarily because visitors outside the region will discover the park.

Many of the trends applicable to snowmobiling also apply to cross-country skiing. Statewide ski use is difficult to measure, and some disagreements exist about projecting trends. Cross-country skiing may be growing at a faster rate than snowmobiling because of the much lower equipment cost. Another contributing factor is the shifting preference among winter sports participants toward more nonmotorized, nature-oriented sports.

Further growth in the popularity of cross-country skiing is limited by the present capacity of trails. In statewide surveys, the majority of cross-country skiers noted a major shortage of quality trails and facilities (MDNR 1984). Skiing could increase more rapidly if the following needs were met: large trail networks, scenic views and attractive terrain, isolation from snowmobiles, and enclosed shelters or warming huts.

Summer Recreation Trends. The most popular summer recreational activities in the park are fishing, boating, camping, hiking, and canoeing. Due to the combined effects of insects, level terrain, and trail locations, few people visit the park primarily to hike. The best hiking time is the fall when the insects are gone, daytime temperatures are cooler, and fall colors brighten the landscape.

Hiking is increasing statewide, but its character appears to be changing. The Department of Natural Resources projects that hiking for nature study will increase 22 percent between 1978 and 1995, while orienteering and backpacking will decrease by 27 percent and 16 percent, respectively.

Even without additional facilities and trails, park hiking is projected to grow by about 5.5 percent (approximately 325 visitors per year; in 1985 an estimated 5,900 hikers used the park). Some of these hikers will be new visitors, and others will be repeat visitors.





**environmental consequences**



## WINTER ALTERNATIVES

### DRAFT PLAN

The draft plan would modify existing recreational use patterns by replacing approximately 34 miles of unmaintained snowmobile routes with 29.4 miles of maintained and designated snowmobile trails, and by providing an additional 22.4 miles of cross-country ski trails, for a total of 51.8 miles of new trails. Winter recreation trails on the Kabetogama Peninsula would include 21.3 miles of ski trails, 9.8 miles of existing snowmobile portages, and 29.4 miles of snowmobile trails, totaling 60.5 miles (an increase of 13 miles compared to existing conditions). The total parkwide trail mileage would be 79.7 miles, 17.6 miles more than under existing conditions.

### Soils

Analysis. Excavation and disturbance of soils would be minimal and localized because new or realigned trails would follow terrain features. Approximately 0.1 acre total would be covered by an overnight cabin and two lunch shelters, and soils on the building site would be compacted during construction.

Impacts on soils from the maintenance of existing snowmobile portages and ski trails would be insignificant. Impacts from use would also be insignificant because almost all traffic (mechanized or foot) occurs from December through mid-April on snow-covered, frozen ground.

Conclusion. Effects on soils would be insignificant.

### Vegetation

Analysis. Constructing 51.8 miles of new trails would disturb 79.6 acres of forest vegetation, as shown below:

22.4 miles of new ski trail (10-foot-wide corridor) would affect 26.9 acres (1.2 acres per mile).

21.4 miles of parallel one-way snowmobile trails (each trail 8 feet wide) between Clyde Creek and Kettle Falls would affect 40.7 acres (1.9 acres per mile).

8.0 miles of two-way snowmobile trail (12-foot-wide corridor) would affect 12.0 acres (1.5 acres per mile); much of this trail would follow an abandoned logging road that has regrown with saplings.

The removal of selected overstory trees for trail construction would locally increase light penetration to the forest floor and consequently increase the diversity, abundance, and growth of grasses, forbs, and shrubs along trail corridors.

Maintaining a total of 79.7 miles of ski and snowmobile trails by annual brushing and clearing would affect 117.7 acres, or 0.06 percent of the park's land area. The effect would be to stimulate the growth of herbaceous and shrubby species such as blueberry, raspberry, red tag alder, red osier dogwood, and beaked hazel. Winter use of trails would have a negligible overall effect on vegetation.

Two lunch shelters along the Black Bay ski loops, and one overnight cabin near the outlet of Locator Lake, would be constructed for cross-country skiers. About 1 acre of vegetation would be temporarily affected by construction activities; vegetation would be permanently removed on approximately 0.1 acre covered by the structures. The concentration of visitor use around each site would affect another 1 to 2 acres of vegetation because of firewood gathering and other activities. Bottled propane gas would be supplied for cabin heating to reduce the impact of wood gathering.

Exotic plants could continue to be brought into the park by means of trail traffic and maintenance and could become established in disturbed areas. Exotic plants represent about 10 percent of the plant species around backcountry campsites in the Boundary Waters Canoe Area Wilderness.

Conclusion. A total of 117.7 acres would be affected by trail construction and maintenance activities, or 0.06 percent of the park's land area. This effect on vegetation would be insignificant.

### Wildlife

Constructing 51.8 miles of new ski and snowmobile trails would directly affect a total of 73.3 acres of wildlife habitat. Effects during the construction period would be locally confined to vegetation along the trail swath and to wildlife using that vegetation. Removing vegetation for construction and maintenance would have a negligible effect on wildlife populations on a parkwide basis. Removal of selected overstory trees would locally decrease the habitat for cavity nesting birds and mammals. The removal of overstory trees and the resulting increase in ground vegetation would lead to localized increases in ground-dwelling invertebrates, birds, and small mammals. White-tailed deer, moose, and black bear would also utilize the increased diversity of food resources associated with trail corridors and follow them as travel routes.

Annual maintenance of 79.7 miles of trail would directly affect 117.7 acres of wildlife habitat (0.06 percent of the park's land area). Wildlife would be temporarily displaced from the immediate vicinity of work crews because of human presence and noise from trail maintenance equipment, such as chain saws and brush-cutters; the overall effect on wildlife would

be negligible. Except for year-round use of the trails at the Rainy Lake visitor center and at State Point, there would be negligible use of ski and snowmobile trails for summer hiking.

Effects on Wolves and Ungulates. Some generalities can be drawn from studies of responses by large ungulates (deer, moose, and elk) to winter recreationists. In several studies in northern forested areas, nonhunted ungulates moved approximately 200-500 feet away from snowmobile and ski trails during heavy recreational use periods, then returned to feed and occupy habitat adjacent to the trails during low use periods (Aune 1981; Dorrance et al. 1975; Eckstein et al. 1979; Ferguson and Keith 1982). Persons on foot (hikers, skiers, or snowshoers) seem to have greater effects than snowmobilers do by causing animals to run sooner and farther than they run from snowmobiles (Eckstein et al. 1979; Freddy et al. 1986). In late winter the mobility of animals may be reduced by deep snow and a weakened physical condition, giving the impression of increased tolerance to humans (Richens and Lavigne 1978). A study of captive white-tailed deer fitted with heart-rate monitors demonstrated an increased pulse rate when a snowmobile passed (Moen et al. 1982). The increased pulse rate did not diminish during a three-month test period, and it occurred without deer standing up or moving away. One study indicated a reduction of rabbits and rodents near snowmobile trails because of increased predation from foxes using the packed trails to aid hunting (Newman and Merriam 1972).

In general, studies of winter ski and snowmobile recreation effects on large wintering animals document temporary displacement of animals from the habitat adjacent to trails during heavy travel periods, but without overall reductions of wildlife populations due to recreational use. If wintering animals are weakened due to displacement and expenditure of extra energy as a result of human recreational trail use in areas with comparable conditions to Voyageurs, it does not appear to be significant. No known adverse effects on wolves or ungulates as a result of winter recreational use (for example, decreased survival rates or reproductive success) have been documented. In commenting about the park's Draft Natural Resource Management Plan, L. David Mech, a wolf biologist with the U.S. Fish and Wildlife Service, states,

I know of no evidence, or reason to believe, that snowmobiling, summer or winter visitor use, winter camping, or other winter sports will have a detrimental effect on the survival of [Voyageurs] wolf populations. Wolves' avoidance of well used human trails should cause them no real inconvenience nor should it interfere with their hunting. (See appendix C.)

White-tailed deer are generally evenly distributed over the land mass of the park, and trail development would inevitably pass through deer habitat. Moose wintering areas would generally be avoided by trails, with the exception of the existing and proposed ski trail loops at the west end of the Kabetogama Peninsula. Proposed trails would bisect one or more territories of wolf packs using the park.



As a means of comparing areas of wildlife habitat potentially affected by different trail development alternatives, acreages adjacent to proposed trails were calculated. The calculation is based on the assumption that wildlife using habitat within 200 feet of either side of a trail (400 feet total) may be affected to some extent by human trail use, but that, as noted above, survival will generally be determined by factors other than human recreation. The distance of 200 feet is used because objects are usually hidden at this range in the park as a result of dense vegetation, and this distance was mentioned in several wildlife/recreation studies. The equivalent distance from the proposed parallel one-way snowmobile trails would include 200 feet from the outer edges of each trail, plus the median between the two trails, which would average 150 feet (550 feet total). Snowmobile and cross-country ski trails are considered together. The effects of trail use in both winter and summer are considered because winter is the critical season for survival and summer is critical for female deer and moose with fawns or calves. It is also assumed that the quality of habitat is roughly equal for all land areas of the park. The area within 200 feet of a trail equals 48.5 acres per mile, or 60.6 acres per mile for the parallel one-way snowmobile trail system.

Under the draft plan the habitat within 200 feet of trails that could potentially be affected by recreational use would amount to 4,124 acres (or 3.1 percent of the park's land area). On the Kabetogama Peninsula 3,222 acres (or 4.3 percent of the peninsula's land area) could potentially be affected.

Potential disturbance to wintering wildlife from cross-country skiing would occur on a total of 32.4 miles of trail: 11.2 miles of trail at the Rainy Lake visitor center, State Point, and near Daley Brook (between the Ash River Trail and Nebraska Bay); 10 miles of loop trail at Black Bay; and 11.2 miles of trail from Black Bay to Locator Lake. Skiing on the trails at the Rainy Lake visitor center, State Point, and Daley Brook would have minimal effects on wildlife. The quality of habitat in these areas is not as high as that on the Kabetogama Peninsula and in the southeastern portion of the park because these areas are near the shorelines of major lakes, existing roads, and developed areas. The Daley Brook ski trail would be carefully routed to avoid possible white-tailed deer wintering yards that are especially important to deer during years with deep snow, although some localized disturbance of wintering deer would continue as long as this trail remained in use. To mitigate any adverse effects during severe winters, the trail could be temporarily closed.

The use of loop trails at Black Bay would continue any existing effects, including some displacement of wildlife during use hours. Wildlife, including deer, moose, and wolves, continue to use the area, as indicated by fresh tracks in the snow and aerial observations.

Constructing a new ski trail to the west end of Locator Lake would extend use to the Chain of Lakes. Initially skiing on the Chain of Lakes would be less than existing levels of snowmobile use. Because it could be many years before ski use on the lakes equaled or exceeded existing levels of snowmobile use, disturbance of wintering wildlife would likely

decrease for the foreseeable future. The effect on wildlife from skiers using the proposed overnight cabin at Locator Lake would be similar to day use effects. The cabin would encourage skiers to penetrate farther east on the Kabetogama Peninsula than they probably would otherwise. Skiers would not be restricted to traveling only on maintained trails, but due to the difficulty of off-trail skiing, such travel would be minimal. If resource monitoring indicated the need to close or reroute trails on a temporary basis, then a designated trail system would be easier to patrol.

The proposed 26.0-mile trans-peninsula snowmobile trail from Moose Bay to Kettle Falls would be routed near shorelines to leave large areas of land without trails and to avoid moose range in the southeastern portion of the peninsula. Use of this trail would consolidate snowmobile travel along one corridor on the Kabetogama Peninsula, thus reducing the area of existing effect. The 3.4-mile snowmobile trail from Gold Portage to the west park boundary would be routed to avoid moose habitat. Potential impacts on wildlife are expected to be minimal.

Compared to the no-action alternative, human disturbance of wintering moose and deer would locally decrease because the northwestern and southeastern portions of the Kabetogama Peninsula would be closed to snowmobile use. Specifically, unmaintained snowmobile routes to the Chain of Lakes, and Shoepack, Ek, Cruiser, Oslo, Brown, and Beast lakes would be closed. Consolidating snowmobile use on the trans-peninsula trail would affect less habitat under this alternative than under the no-action alternative, but more than under the minimum access alternative. Closing O'Leary and Little Trout lakes in the southeastern portion of the park to snowmobile use would protect the concentration of wintering moose on the southeast side of Namakan Lake.

It is assumed that most park users would not intentionally chase or harass wildlife. When visitors view wintering wildlife, particularly when they try to get a little closer for a better look or a photograph, they may unintentionally cause the animal to modify its behavior. Park management programs, public education, and ranger patrols would help minimize intentional or unintentional harassment of wildlife. Restricting snowmobiles to designated trails and safety portages while on land would also help minimize adverse effects on animals. The conditions on land surfaces are also not conducive to snowmobiling off maintained trails because of the visually dense undergrowth and unconsolidated snow adjacent to the trail.

Research and monitoring programs would be undertaken to document the effects of winter trail construction, use, and maintenance on the park's ungulate, predator, and scavenger populations. If research and monitoring revealed significant unanticipated resource impacts from a particular trail, that trail would either be temporarily closed, rerouted, or closed permanently and rehabilitated. Closed trails would require only a few years to revegetate because of high moisture availability in most of the park and a relatively long growing season.

Effects on Bald Eagles. Bald eagles in nesting territories near Gold Portage, Tar Point, and Mukooda Lake may currently be disturbed during their courtship period (late February into March) by snowmobilers using the nearby safety portages. The proximity of existing portages to nesting territories is of concern; monitoring is being conducted as part of the resource management program and in accordance with the Northern States Bald Eagle Recovery Plan. If any disturbance to eagles was documented in the future, trails would be temporarily closed or rerouted. Closed trails would be monitored and patrolled to ensure compliance. Summer construction and maintenance activities would be scheduled so there would be no effect on nesting birds.

Effects on Fish. Ice-fishing and its effect on the fish populations of interior lakes on the Kabetogama Peninsula are directly affected by snowmobile access and choice of trail alignment. These lakes are not highly productive and may be easily overfished. For example, without artificial stocking maximum production for lake trout in Cruiser and Little Trout lakes is only about 51 and 106 pounds per lake per year, respectively. Closing snowmobile access to Cruiser Lake on the Kabetogama Peninsula would reduce exploitation of the lake trout population. A few fishermen would continue to be flown in to Cruiser Lake for the day while a very few fishermen would ski or snowshoe in for the day or to camp overnight. Because this lake is a relatively unproductive fishery, reduced fishing pressure would probably benefit the lake trout population.

Conclusion. Implementation of the draft plan would provide more protection for Voyageurs' wildlife populations than the no-action and maximum winter access alternatives, and somewhat less than the minimum access alternative. An estimated 4,124 acres of wildlife habitat throughout the park (3.1 percent of the park's land surface), including 3,222 acres on the Kabetogama Peninsula (4.3 percent of the peninsula's land area), could potentially be affected by winter recreational activities. The expected effect on wildlife would be temporary displacement during recreational use hours. No known effects on survival rates or reproductive success of wolves and ungulates have been documented. The effects on wildlife populations under the draft plan are expected to be insignificant.

Cumulative Effects on Wildlife Habitat. Other natural resource programs would affect park wildlife independently of trail development, and all proposed trail actions must be considered in terms of the cumulative effect on wildlife.

The park ecosystem has been significantly modified by humans since 1890, resulting in a less diverse and maturing forest ecosystem supporting fewer animal species and lower wildlife populations. A program to reestablish fire to its natural role in the ecosystem has been approved as one of the park's natural resource management programs. Managed fires would help return wildlife habitat to a higher level of productivity, similar to pre-1890 conditions. This would subsequently benefit populations of prey, predator, and scavenger species. As an example of



wildlife benefiting from fires, the 14,000-acre Little Sioux fire in nearby Superior National Forest in 1971 resulted in a fivefold increase in the moose population (including immigration), even though white-tailed deer were present (Irwin 1975).

Another proposed resource management program is the reintroduction of woodland caribou and elk to the park. Caribou utilize different forest habitat than do deer, moose, and elk, and their reintroduction would increase prey availability for wolves, while causing little competition with other species. Moose, caribou, and elk are more successful at coping with the harsh northern climate and forest conditions than white-tailed deer. The reestablishment of caribou and elk would not only improve wildlife viewing opportunities, but by returning missing members of the ecosystem it would also improve the species diversity, productivity, and stability of the entire park ecosystem.

The restoration of fire, habitat improvement, reestablishment of caribou and elk, and increased wildlife populations should be the primary factors for determining a productive and stable park ecosystem in the future. Increased productivity and diversity would enhance the natural ecosystem's ability to withstand outside influences such as human recreational development, increased park visitation, introduced forest and wildlife pathogens, or unusual weather conditions.

### Air Quality

Analysis. Air quality would continue to be locally and temporarily affected by snowmobile exhaust emissions along trails. Exhaust fumes would be most noticeable during peak use hours (10 a.m. to 4 p.m.), particularly at trailheads where air quality could be degraded. Emissions would continue to a minor degree on the Kabetogama Peninsula, but they would not be as widespread as under present conditions because use would be restricted to designated trails and lakes.

Construction and annual maintenance of trails by brushing and clearing could have minor, temporary, localized effects on air quality if gasoline-powered tools were used. Summer and winter emissions would not be high enough to exceed the standards established for class I areas in the Clean Air Act of 1977.

Conclusion. Impacts on air quality would be insignificant.

### Water Quality

Analysis. Snowmobile use during the life of the plan would be well below levels of use that caused the deposition of lead on snowpack in Yellowstone National Park (Aune 1981) and of hydrocarbons in a beaver pond in Maine (Adams 1975). The overall effect on water quality in Voyageurs is not expected to be significant.

Trail construction and maintenance would not be expected to cause significant siltation because there would be little or no excavation under any alternative. Any area of soil disturbance would rapidly revegetate, thus stabilizing soils and minimizing further erosion.

Conclusion. Effects on water quality are not expected to be significant.

#### Floodplains and Wetlands

Analysis. Snowmobile trails and portages would not be subject to flooding during the winter use season. Foot trails are excepted from compliance with Executive Order 11988, "Floodplain Management." The local weather, regulated lake levels, and low-lying terrain do not result in any significant safety hazard from sudden flooding. Any flooding of trails would be from high water associated with wetlands and beaver activity.

Wetlands and beaver ponds would continue to be crossed by snowmobile safety portages and cross-country ski trails, but long- or short-term adverse effects would be negligible because emergent pond vegetation is dormant during winter and their roots are protected by ice and snow.

Beneficial effects of wetlands (for example, as summer wildlife habitat, open space, water storage, and water filtration) would not be affected by trail maintenance and use under any alternative.

Conclusion. There would be no significant effects on floodplains or wetlands.

#### Cultural Resources

Impacts to known archeological and historic sites from trail development would be minimal because trails would be carefully routed to avoid such sites. Effects on archeological resources from the use of approximately 80 miles of winter trails would be negligible because the snowpack would further protect resources. Other than snowmobile trails and portages near the Kettle Falls Historic District, no trails would be routed near historic structures.

#### Visitor Use

Analysis. Providing a variety of winter trails would create more opportunities for visitors to enjoy the park's natural resources, which would result in increased park visitation, with a higher potential for encounters with other winter recreationists, increased litter, noise, and other signs of human use. These effects could detract from a wilderness-type experience and reduce feelings of isolation and solitude desired by some visitors.



Providing separate trail systems for skiing and snowmobiling would reduce conflicts between these user groups. Skiers might be able to hear snowmobiles, but this would be a relatively minor annoyance.

The overall experience for snowmobilers would be improved because 44 miles of trails would be designated, improved, and maintained, compared to approximately 16 miles available under existing conditions (not counting 34 miles of undesignated and unmaintained routes). Maintaining trails would provide a less strenuous, safer, and more enjoyable touring experience.

Establishing an overland route on the Kabetogama Peninsula would extend the snowmobile season and also allow snowmobiling opportunities during periods when poor ice conditions on the major lakes prevent snowmobiling. Eliminating the Chain-of-Lakes, Shoepack Lake, and Cruiser Lake routes would result in the loss of scenic touring and ice-fishing opportunities for snowmobilers. The Chain of Lakes were not reserved for snowmobiling under the draft plan because like the large lakes they are also subject to slush ice conditions and therefore would not provide reliable snowmobiling conditions during some years. The new trans-peninsula snowmobile trail would provide access to a few small interior lakes, but some would not consider the experience to be as scenic as snowmobiling on the existing Chain-of-Lakes route because of the lack of frequent, expansive views. Curving, one-way parallel trails would improve safety by separating traffic on low-speed trails. Such routes would also provide a nature-oriented experience.

Cross-country skiing opportunities would be increased by constructing an additional 22.5 miles of trail, compared to 10 miles at present. Improving the Black Bay ski trail loops, and providing new trails at the Rainy Lake visitor center, State Point, and Daley Brook, would enhance scenic and recreational opportunities. The trail at the Rainy Lake visitor center would provide opportunities for beginner skiers, while the terrain at State Point and around Daley Brook would allow trails to be developed for beginners as well as more advanced skiers. Providing trails for a variety of users would reduce congestion and improve safety, compared to present conditions. The trails at the Rainy Lake visitor center and State Point could be used for winter interpretive activities, thus increasing recreational opportunities. The Daley Brook trail would provide good opportunities for visitors to see wildlife, much like the present Black Bay ski trail. The Daley Brook trail would provide an alternative skiing experience to complement the groomed and tracked, state-maintained ski trail south of the Ash River Trail and outside the park boundary. A trail providing skiing access to the Chain of Lakes would also be developed, and one overnight cabin would be constructed near the west end of Locator Lake for skiers. This shelter would be available by reservation only, with the possibility of a minor fee to help pay for maintenance costs.

All of these actions would improve the experience for cross-country skiers by providing opportunities to ski in various park environments, and also to take a two-day trip and stay overnight in the park. Skiing in a

national park setting would offer a unique scenic experience if trails were routed through a variety of interesting terrain coupled with opportunities for viewing wildlife.

Noise generated by snowmobiles and trail maintenance equipment could have physiological effects as well as the potential to adversely affect some visitor experiences. Prolonged exposure to snowmobile noise is generally regarded as harmful by industrial safety research; however, adequate ear protection devices are readily available to snowmobilers. Hearing loss among populations of snowmobilers has not been documented. Hazards to nearby nonsnowmobilers would be insignificant because the intensity of noise diminishes rapidly as the distance from the source increases. Noise from trail maintenance equipment, such as chain saws and brush-cutters during the summer season, would also be insignificant. Trail crew employees would be required to wear adequate ear protection devices.

Machine noise does have a negative aesthetic effect on visitors who are seeking quiet experiences, such as some skiers. As with any aesthetic experience, analysis is difficult and tends to be subjective with many variables, for example, what the nonsnowmobiling visitor's expectations are, numbers of skiers and snowmobilers involved, duration of noise exposure, number of noise experiences per day, distance from the noise source, weather, and screening forest versus open frozen lakes. In general, by restricting snowmobile use on land to designated trails, large areas of the park would remain quiet, thus affording ample opportunities for quiet experiences. It is probable that snowmobile noise would carry long distances only on the large lakes under certain weather conditions.

Conclusion. Recreational opportunities would be improved for both cross-country skiers and snowmobilers by providing 61.8 miles of maintained and groomed trails, in addition to 17.9 miles of existing snowmobile portages. Visitors would have more opportunities to enjoy the park's natural resources. Increased visitation could intrude on wilderness-type experiences for some visitors.

### Local Economy

Analysis. The major economic effects of winter trail development would be due to use by visitors from outside the region. No increase in local participation in winter sports is foreseen as a result of trail development because it is assumed that those residents inclined to ski or snowmobile are already doing so and would continue to do so. In terms of numbers of days, local residents currently devote an estimated 4,100 days per year to cross-country skiing, and 9,000 days per year to snowmobiling. These figures are not projected to change significantly over the life of the plan.

The situation is different for visitors from outside the region, who would likely be attracted to snowmobile and cross-country ski trails in a national park setting. Because visitors would be coming to Voyageurs specifically to participate in these activities, it is possible to estimate how much they

would spend per day in the local area (for example, for lodging, food and groceries, and automobile-related expenses; see "Affected Environment"). These expenditures would presumably be reinvested by local businesses, for example, a motel owner would likely use his gross receipts to pay salaries and taxes and to buy supplies and services. This reinvestment would thus further benefit the local economy, and a doubling effect has been used to estimate the effect.

Local resorts and commercial interests could develop winter tour packages that included opportunities for cross-country skiing and snowmobiling. Successfully marketing such packaged tours to cross-country skiers and snowmobilers would require creative packaging and advertising.

Significant capital investments would also be required to provide the modern facilities that winter recreationists have come to expect in other resorts. The projections in this document assume that the resorts can both market the available opportunities and obtain the necessary financing for construction. However, the success of this effort is outside the purview of the National Park Service, and there is no assurance that visitors would respond to a marketing campaign. Voyageurs is located far from major population centers, and local resorts would have to compete with resorts that are closer to metropolitan areas and that have better snow conditions, as well as with other established resorts in the Arrowhead region.

Under the draft plan both skiers and snowmobilers from outside the local region would be expected to increase. Since the park has only been established for 12 years, no firm projections can be made.

More cross-country skiers from outside the local region would be likely to come because of the continued growing popularity of the sport and the construction of warming huts and new trails in scenic areas. If skiing continued to increase in popularity, annual use by nonlocal visitors might increase from 500 days at present to 3,900 days. If this occurred, annual expenditures 10 years after full plan implementation would increase by an additional \$136,000 (\$272,000 after reinvestment).

Snowmobilers would be attracted to the park by several factors already at work: (1) the improved Voyageur Trail outside the park, which connects the mainland resorts, (2) the newly opened State Corridor Trail, and (3) the projected statewide snowmobile increase of 14 percent. Snowmobile use would further increase under the draft plan because park trails would be maintained, brushed, and groomed, and they would provide a leisurely, resource-oriented viewing experience unique to the region. However, the increase in use could be smaller than projected because trails would be designed for slower speeds (25 mph), and they could seem less scenic than present unmaintained routes. Under this alternative, nonlocal park snowmobile use is projected to increase from 1,000 days at present to 5,000 days after 10 years, with an annual increase in expenditures of an additional \$400,000 (\$800,000 after reinvestment).



The above projections are only estimates that are most useful for comparing alternatives. For planning purposes, this alternative might result in a total annual benefit to the local economy of \$1,072,000. This increase would be expected to occur 10 years after full implementation of the draft plan. This increase in local income from expenditures by visitors from outside the region would represent new money to the economy. Resorts on Kabetogama Lake would benefit slightly more than resorts in other areas because of the proximity of a longer ski trail. All resorts would benefit from increased snowmobile expenditures, but Crane Lake would gain the least due to its location. There would be no effect on park concessioners.

The local economy would also be affected as a result of money spent by construction and maintenance contractors. Some of the funds spent for a one-time construction cost of \$642,300 would benefit the local economy during the construction period. The magnitude of this benefit would depend on which contractor successfully bid on the project, where he hired his work force, and what supplies and services he acquired locally. Additional benefits would accrue as local workers and businesses reinvested the income they received from the primary contractor.

The expenditure of \$78,000 for the maintenance of trails and other facilities would also have a local economic effect. While such work would be conducted primarily by the park staff, perhaps as much as 20 percent might be done by contractors or cooperating associations. An estimated \$101,500 would be spent annually for resource management and visitor protection. Most of the funds spent for maintenance and management would be in the form of salaries to local residents and thus would directly benefit the local economy. Unlike construction funds, this source of revenue would continue into the future.

Conclusion. Compared to present trends, full implementation of the draft plan would double nonlocal visits to the park for skiing and almost double nonlocal visits for snowmobiling. This increased visitation could double additional annual income to the local economy, benefiting local businesses and resorts. One-time construction expenditures could add \$642,300. Annual maintenance and management expenditures would add \$179,500 to the local economy.

#### NO-ACTION ALTERNATIVE

The no-action alternative would continue existing winter recreational use patterns, with 10.0 miles of cross-country ski trails and 17.9 miles of snowmobile portages. In addition, the use of 34 miles of unmaintained snowmobile routes throughout the park would be allowed to continue.

#### Soils

There would be no significant effect on soils under the no-action alternative.



## Vegetation

Maintaining 27.9 miles of existing trails and portages would affect 38.7 acres of vegetation, which would primarily stimulate the growth of shrubby and herbaceous vegetation, as discussed under the draft plan. Continued use of existing unmaintained, undesignated snowmobile routes and maintained ski trails would have a negligible effect on vegetation (0.03 percent of the park's vegetation). There would be no new impacts on rare and unusual plant communities or associated species.

## Wildlife

Analysis. Annual maintenance of 27.9 miles of existing winter trails and portages would directly affect 38.7 acres of wildlife habitat. Compared to present conditions, there would be no new effects on wildlife habitat parkwide.

The no-action alternative would continue the existing parkwide recreational use of 27.9 miles of maintained trails and portages, plus dispersed use by skiers and snowmobilers of roughly 34 miles of unmaintained routes on the Kabetogama Peninsula and in other park areas. Parkwide 2,958 acres of ungulate habitat could potentially be affected by winter recreational activities (2.2 percent of the park's land area). On the Kabetogama Peninsula approximately 2,643 acres of habitat adjacent to 48 miles of maintained trails and unmaintained routes could be affected (or 3.5 percent of the peninsula's land area).

Continued use of approximately 62 miles of unmaintained snowmobile routes and cross-country ski trails would perpetuate existing use patterns. Wildlife tend to habituate to regular use along established trails, and adverse effects are generally most severe whenever and wherever snowmobilers or skiers leave established routes. However, the heavily timbered and varied terrain of Voyageurs National Park makes it very hard, if not impossible, for snowmobilers and skiers to travel off-trail. Because skiers and snowmobilers generally follow maintained trails or snowmobile tracks, there would probably be little additional disturbance to wildlife from off-trail skiing.

As described under the draft plan, bald eagles may currently be affected in late winter by snowmobile use of portages near Gold Portage, Tar Point, and Mukooda Lake. These potential effects would continue under the no-action alternative. Any documented effects would be mitigated by temporarily closing or rerouting trails.

Ice-fishing for lake trout would continue in Cruiser Lake on the Kabetogama Peninsula. Fishermen would continue to snowmobile, fly, or ski in and camp overnight. Cruiser Lake is a relatively unproductive fishery, and continued fishing could overexploit and reduce the lake trout population. Any documented adverse effects would be mitigated as discussed in the Natural Resource Management Plan.

Conclusion. Under this alternative approximately 2,958 acres of wildlife habitat (2.2 percent of the park's land area), and 2,643 acres of habitat on the Kabetogama Peninsula (3.5 percent of the peninsula's land area), would continue to be potentially affected by winter recreational activities. As described under the draft plan, the effect on wildlife would probably be temporary displacement during recreational use hours, and no long-term adverse effects have been documented under similar conditions. The overall effect on wildlife is expected to be insignificant.

#### Air Quality

Air quality would continue to be locally affected by snowmobile exhaust emissions, as occurs now. The effect would be most obvious in areas of concentrated use. The overall effect would be insignificant.

#### Water Quality

Current snowmobile use concentrations are well below levels that caused deposition of lead in Yellowstone (Aune 1981) and hydrocarbons in a beaver pond in Maine (Adams 1975). The overall effect is not expected to be significant.

#### Floodplains and Wetlands

The no-action alternative would have no significant effect on floodplains and wetlands.

#### Cultural Resources

Existing trail corridors have not been surveyed for archeological materials; therefore, it is not known what impacts, if any, may be occurring. A survey would determine the existing effects along the 62 miles of formal trails and informal routes. If impacts were documented, corrective measures would be taken. The fact that snowmobiling and skiing occur principally in areas with packed snow would minimize adverse effects on archeological resources. Some vandalism of historic structures does occur, but it is not necessarily the result of present trail alignments.

#### Visitor Use

Analysis. Snowmobiling would continue on traditional routes, portages, and frozen lake surfaces. Access by way of unmaintained, informal routes to the popular Chain of Lakes, Shoepack Lake, and Cruiser Lake would continue. These routes would continue to provide a scenic, although very primitive, snowmobiling experience. With no maintenance, they would become overgrown by vegetation, thus increasing the potential

for snowmobiling accidents. As park visitation increased, these narrow two-way routes could become congested. Safety concerns and congestion would likely cause dissatisfaction among snowmobilers. Over time, fewer and fewer visitors would want or be able to travel over these routes. The dependence of travel over ice, navigation difficulty, and lack of marked trails would continue to discourage nonlocal snowmobilers.

Cross-country ski opportunities would remain unchanged. The 10-mile Black Bay ski loop would continue to be used by both beginner and more advanced skiers. Some conflicts exist because of both slow and faster skiers using the same trail, and conflicts would increase with use.

As described under the draft plan, noise generated by snowmobiles and trail maintenance equipment could adversely affect the experiences of some visitors. Because snowmobile use on the Kabetogama Peninsula would not be confined to specific corridors, large areas of the park would be subject to noise from snowmobiles, making it hard for some visitors to enjoy their stays in the park. Noise from trail maintenance equipment, such as chain saws and brush-cutters during the summer season, would be insignificant.

Conclusion. There would be no significant changes in visitor use patterns or recreational experiences under the no-action alternative. Without maintenance, 34 miles of existing snowmobile routes on the Kabetogama Peninsula could become overgrown and less desirable for use.

### Local Economy

Analysis. Under the no-action alternative both skiers and snowmobilers would be expected to increase mainly as a result of growth in visits from outside the region. As described under the draft plan, no firm projections can be made since the park has only been established for 12 years.

Increased numbers of skiers from outside the local region would be due to the growing popularity of the sport. If the present rate of growth continued, annual use in 10 years might increase from 500 days at present to 1,900 days, with an increase in annual expenditures of an additional \$56,000 (\$112,000 after reinvestment).

As described under the draft plan, snowmobilers would be attracted to the park by improvement of the Voyageur Trail outside the park and the recent construction of the State Corridor Trail, as well as the projected statewide snowmobile increase of 14 percent. Considering these factors, park snowmobile use by nonlocal visitors could increase over the next 10 years from 1,000 days at present to 3,000 days. If this occurred, annual expenditures would increase by an additional \$200,000 (\$400,000 after reinvestment).

The above projections are only estimates that are most useful for comparing alternatives. For planning purposes, current growth trends

might result in a total annual benefit to the local economy of \$512,000. This increase in local income from expenditures by nonlocal visitors would represent new money to the economy. There would be no effect on park concessioners.

No additional trail construction would take place under this alternative; however, an additional economic impact would result from the park's annual expenditure of \$23,700 for maintenance and \$88,700 for resource management and visitor protection.

Conclusion. Based on present trends, over the next 10 years nonlocal visits for cross-country skiing are projected to increase by nearly four times compared to existing levels, and for snowmobiling by three times. After 10 years this increased use could add \$512,000 annually to the local economy, benefiting local businesses and resorts. There would be no additional construction expenditures; annual maintenance and management expenditures would add \$112,400 to the local economy.

#### MINIMUM ACCESS ALTERNATIVE

Under the minimum access alternative 11.2 miles of new ski trails on the mainland would be constructed; 16.8 miles of existing snowmobile portages would be maintained; and 10.0 miles of existing ski trails would be closed and allowed to revegetate. A total of 28.0 miles of trail would be available for use. Existing snowmobile use patterns would be drastically changed by prohibiting all overland snowmobile travel in the park (other than safety portages).

#### Soils

There would be no significant impact on soils as a result of constructing ski trails or maintaining trails and portages.

#### Vegetation

Analysis. Constructing 11.2 miles of new ski trails (10-foot-wide corridor) would require cutting of trees, understory brush, and herbaceous plants on 13.4 acres (1.2 acres per mile). Tree cutting would have a minor localized effect of opening the forest canopy and removing undergrowth, thus stimulating the growth of herbaceous and shrubby species. Maintaining 28.0 miles of trails by annual brushing and clearing would affect 38.4 acres, which would further stimulate the growth of herbs and shrubs. Altogether less than 0.03 percent of the park's vegetation would be affected.

Closing the 10-mile Black Bay ski trail on the west end of the Kabetogama Peninsula would allow 12 acres of mixed conifer and deciduous forest to revert to natural conditions over the next 10 to 20 years.



Conclusion. A total of 38.4 acres of vegetation would be affected by trail construction, use, and maintenance activities, or 0.03 percent of the park's land surface. This effect on vegetation would be insignificant.

## Wildlife

Analysis. Clearing 13.4 acres of mixed forest and shrub vegetation to construct ski trails would have localized effects on wildlife habitat and species abundance. As described under the draft plan, the removal of selected overstory trees would decrease habitat for some wildlife and improve habitat for ground-dwelling invertebrates, birds, and small mammals because of increased shrubby and herbaceous vegetation. Annual maintenance of 28.0 miles of trails would require the cutting of 38.4 acres of shrubs and herbaceous plants, which would help maintain browse for wildlife.

Closing and rehabilitating the 10-mile Black Bay ski trail loop system on the west end of the Kabetogama Peninsula would affect 12 acres of vegetation and wildlife habitat. Old logging roads and trails closed in the past have quickly reverted to an undisturbed state of dense shrubs and closed canopy forest, resulting in an overall reduction in habitat productivity and browse along the abandoned roads and trails, and this would likely be the result after closure of the Black Bay trail.

Under the minimum access alternative, winter recreational use of 28.0 miles of winter trails would affect a total of 1,411 acres of habitat (or 1.1 percent of the park's land area). Use of 9.8 miles of snowmobile portages on the Kabetogama Peninsula would potentially affect 509 acres of habitat (or 0.7 percent of the peninsula's land area).

Closing the Black Bay ski trail loop system and prohibiting overland snowmobile use in the park (except for the existing 16.8 miles of snowmobile portages) would protect park wildlife from human disturbance on the Kabetogama Peninsula and in the southeastern portion of the park. As described under the draft plan, cross-country skiing and the accompanying human disturbance to wintering wildlife would occur on the 11.2 miles of ski trails at the Rainy Lake visitor center, State Point, and near Daley Brook. Because the quality of habitat in these areas is not as high as that on the Kabetogama Peninsula and in the southeastern portion of the park, disturbances would not be significant. To mitigate any adverse effects to wintering white-tailed deer during severe winters, the Daley Brook ski trail could be temporarily closed.

Reducing the extent of winter trails would reduce the displacement of wildlife from habitat along winter trails. The absence of trails on the Kabetogama Peninsula and in the southeastern portion of the park would allow predator/prey interactions to occur without any human interference.

As described under the draft plan, bald eagles may currently be affected in late winter by snowmobile use of portages near Gold Portage, Tar Point, and Mukooda Lake. These potential effects would continue under

the minimum access alternative. Any documented adverse effects would be mitigated by temporarily closing or rerouting trails.

Closure of the park to land-based snowmobile use, except for continued use of existing portages, would eliminate ice-fishing in Cruiser Lake on the Kabetogama Peninsula. A few fishermen would continue to be flown in, or to ski in and camp overnight. Because this lake is a relatively unproductive fishery, reduced fishing pressure would probably benefit the lake trout population.

Conclusion. Restricting snowmobiles to safety portages and frozen lake surfaces in the park would eliminate most potential impacts on wildlife that could be occurring now with unregulated cross-country snowmobile use. A total of 1,411 acres of wildlife habitat (1.1 percent of the park's land surface), and 509 acres on the Kabetogama Peninsula (or 0.7 percent of the peninsula's land area), would be potentially affected by recreational activities. Of all the winter trail alternatives, this alternative would provide the greatest protection to park wildlife populations. Adverse effects on wildlife would be insignificant.

#### Air Quality

Prohibiting snowmobile travel on the Kabetogama Peninsula would eliminate any potential adverse effects on air quality in this portion of the park. Other effects would be insignificant.

#### Water Quality

Effects on water quality, including possible deposition of lead and hydrocarbon compounds, would be minimal under this alternative because land-based snowmobile use would be reduced compared to existing conditions. Ski trail construction would not be expected to cause significant siltation because gradients are low and aligned to avoid excavation, and vegetation quickly stabilizes disturbed areas.

#### Floodplains and Wetlands

The minimum access alternative would have no effect on floodplains and wetlands.

#### Cultural Resources

Use of 28 miles of maintained winter trails in the park (compared to 62 miles of trails and informal snowmobile routes at present) would reduce the potential for adverse effects on archeological resources. Other than the snowmobile trails and portages near the Kettle Falls Historic District, no trails would be routed near historic structures, thus minimizing the potential for adverse effects.

## Visitor Use

Analysis. Snowmobiling on Rainy, Kabetogama, Namakan, and Sand Point lakes would continue to be allowed, and safety portages would continue to be maintained, but use would not be allowed elsewhere in the park. Closing all undesignated snowmobile routes on the Kabetogama Peninsula would result in the loss of backcountry ice-fishing and scenic touring opportunities. Repeat visitors could soon tire of the reduced touring opportunities, and parkwide snowmobiling would likely decrease.

Cross-country ski opportunities would be changed completely. The 10-mile Black Bay ski trail on the west end of the Kabetogama Peninsula would be closed. New trails at the Rainy Lake visitor center, State Point, and near Daley Brook would provide skiers with 11.2 miles of scenic and recreational opportunities in place of the Black Bay trail. As described under the draft plan, the trail at the Rainy Lake visitor center would be designed for beginner skiers, and the trails at State Point and around Daley Brook would be designed for beginners as well as more advanced skiers. The benefits of trails for various skill levels would include less congestion and improved safety. No long-distance ski trails would be available. Using the trails at the Rainy Lake visitor center and State Point for winter interpretive programs would increase the variety of visitor activities. Visitors would have good opportunities to see wildlife near the Daley Brook trail, much like the present Black Bay ski trail.

As described under the draft plan, noise generated by snowmobiles and trail maintenance equipment could adversely affect the experiences of some visitors. However, prohibiting snowmobile use on the Kabetogama Peninsula would increase opportunities for visitors to experience quiet; snowmobile noise on the large lakes would still carry long distances under certain weather conditions. Noise from trail maintenance equipment, such as chain saws and brush-cutters during the summer season, would be the least of any alternative because fewer trails would be maintained.

Conclusion. Recreational opportunities would be the most restrictive of any alternative, with only 28 miles of trails and portages being open and maintained for use. Prohibiting snowmobile use on the Kabetogama Peninsula (except for portages) would adversely affect scenic touring and ice-fishing opportunities.

## Local Economy

Analysis. Under the minimum access alternative the numbers of both skiers and snowmobilers would be expected to increase mainly as a result of growth in visits from outside the region. As described under the draft plan, no firm projections can be made because the park has only been established for 12 years.

The number of nonlocal skiers would probably increase more slowly than under the no-action alternative due to replacing the very popular Black Bay ski loops with three shorter trails in different locations in the park.

Assuming that cross-country skiing continued to grow in popularity, annual use over a 10-year period might increase from 500 days at present to 1,500 days, with annual expenditures projected to increase by \$40,000 (\$80,000 after reinvestment).

Growth in the number of nonlocal snowmobilers would also probably be somewhat slower than under the no-action alternative because snowmobiling would be prohibited on the Kabetogama Peninsula (except for safety portages). As discussed under the draft plan, the improvement and construction of snowmobile trails outside the park, along with an increase in participation statewide, could result in an increase in park use from 1,000 days at present, to 2,500 days after 10 years. Annual expenditures are projected to increase by an additional \$150,000 (\$300,000 after reinvestment).

The above projections are only estimates that are most useful for comparing alternatives. For planning purposes, this alternative might result in a total annual benefit to the local economy of \$370,000. This increase would be expected to occur 10 years after full implementation of the minimum access alternative, and it would represent new money to the economy.

Skier expenditures would not be equally distributed among the various resorts. Rainy Lake resorts would be negatively affected as a result of closing the Black Bay loop trails. However, this impact should be partially offset by constructing a loop trail at the new Rainy Lake visitor center. Kabetogama Lake resorts would benefit slightly more because of the proximity of new trails at State Point and near Daley Brook. There would be no effect on park concessioners.

An additional economic impact would result from the one-time construction expenditure of \$104,400 and from the park's annual expenditure of \$23,300 for maintenance and \$88,900 for resource management and visitor protection.

Conclusion. Compared to present trends, full implementation of the minimum access alternative would probably result in a slower increase in nonlocal visits for skiing and snowmobiling. This slower rate of increased use would add an estimated \$380,000 annually to the local economy after 10 years, 25 percent less than under the no-action alternative. One-time construction expenditures could add \$104,400 to the economy; maintenance and management expenditures would add \$112,200.

#### MAXIMUM ACCESS ALTERNATIVE

The maximum access alternative would provide a total of 178.2 miles of trails, 98.5 more miles than under the draft plan. A total of 58.9 miles of snowmobile trails would be provided, an additional 91.4 miles of ski trails (for a total of 101.4 miles), and 17.9 miles of existing portages. Winter recreation trails on the Kabetogama Peninsula would include 47.2 miles of ski trail, 9.8 miles of existing snowmobile safety portages, and



50.0 miles of snowmobile trail, totaling 107.0 miles of trail. The rest of the park would have 71.2 miles of combined trails.

### Soils

Excavation and disturbance of soils would be minimal and localized because new or realigned trails would generally follow terrain features and be designed for low-speed use. Constructing approximately 25 miles of new two-way snowmobile trail that did not follow old logging roads on the Kabetogama Peninsula would result in more excavation than would parallel one-way trails because these trails would require a wider treadway, longer sight distances, and gentler curves. Some cuts and fills would be required to achieve minimum safety standards, resulting in some loss of topsoil. Maintenance of winter trails would have an insignificant effect on soils, and winter use would have virtually no effect.

Constructing two lunch shelters and five overnight cabins would affect about 3 acres total; 0.7 acre would be permanently covered. Soils at building sites would be compacted during construction. On a parkwide basis, this effect would be insignificant.

### Vegetation

Analysis. Constructing 150.3 miles of new trail would affect a total of 206.6 acres of forest, as shown below:

91.4 miles of new cross-country ski trails would affect vegetation on 109.7 acres (1.2 acres per mile).

21.4 miles of parallel one-way snowmobile trails would disturb 40.7 acres (1.9 acres per mile).

37.5 miles of two-way snowmobile trail would disturb 56.2 acres (1.5 acres per mile).

The type of impacts on vegetation would be similar to those described under the draft plan (loss of selected overstory trees and increased growth of shrubby and herbaceous vegetation), but they would be proportionally greater because of additional trail mileage. Annual maintenance of 178.2 miles of trail would affect 242.3 acres (0.18 percent of the park's land area), which would stimulate the growth of shrubs and herbs, as described for the draft plan.

Two lunch shelters along the Black Bay ski loops and five overnight cabins would be constructed for use by cross-country skiers and snowmobilers. Vegetation would be permanently removed on about 0.7 acre, and an additional 2.3 acres of vegetation would be affected by construction activities and later by the concentration of visitor activities around these sites, as described for the draft plan.

Conclusion. A total of 243.3 acres of vegetation would be affected by trail construction, maintenance, and use, or 0.18 percent of the park's land surface. This effect would be insignificant.

## Wildlife

Analysis. Vegetation removal and brushing of 242.3 acres for trail construction and maintenance would have localized effects on wildlife habitat and species abundance. As described for the draft plan, the removal of selected overstory trees would decrease habitat for some wildlife and improve habitat for ground-dwelling invertebrates, birds, and small mammals because of increased shrubby and herbaceous vegetation. Browse for larger mammals would be locally improved along trail corridors. The overall effect would be minimal.

Parkwide 8,842 acres (or 6.6 percent of the park's land area) could potentially be affected by winter recreational activities. Winter use of trails on the Kabetogama Peninsula could affect 4,774 acres of wildlife habitat (6.3 percent of the peninsula's land area).

Extensive winter trail development would divide habitat into much smaller areas than would trail development under the other alternatives. Much of this development would occur in habitat areas that now receive little or no recreational use, including the Kabetogama Peninsula and the southern and southeastern mainland portions of the park. Trails would bisect two areas of moose habitat and all park wolf pack territories. Numbers of ungulates and wolves could potentially be reduced.

Human use of five overnight cabins would have about the same displacement effect on wildlife as day use, but the presence of cabins would encourage skiers to make longer trips, resulting in effects on larger areas of habitat.

As described under the draft plan, bald eagles may currently be affected in the late winter by snowmobile use of portages near Gold Portage, Tar Point, and Mukooda Lake. These potential effects would continue under the maximum access alternative. Any documented disturbances would be mitigated by temporarily closing or rerouting trails.

Development and promotion of an extensive system of winter trails in Voyageurs would provide easy visitor access to a number of park interior lakes that currently receive moderate (Cruiser Lake) to very low levels of angling use. Ice-fishing would probably not increase on interior lakes except at Cruiser, because of the lake trout fishery. Any documented adverse effects would be mitigated as part of the natural resource management program.

Conclusion. Implementation of the maximum winter access alternative would have more potential effect on wildlife habitat than the other winter access alternatives. An estimated 8,842 acres of wildlife habitat (or 6.6 percent of the park's land area) and approximately 4,774 acres on the

Kabetogama Peninsula (6.3 percent of the peninsula's land area) would be within 200 feet of trails, with potential effects on animals from recreational traffic. This is nearly three times the habitat area potentially affected by existing use and two times the area potentially affected by the draft plan. Even though it is not certain that wildlife would be negatively affected by recreational activity proposed in this alternative, it would be a large increase in habitat and wildlife exposed to recreational use of trails (within 200 feet).

#### Air Quality

Air quality would continue to be locally and temporarily affected by construction and maintenance activities, as described under the draft plan. Effects would increase slightly because of more projected snowmobile use and increased trail mileage, but the overall effect is expected to be insignificant.

#### Water Quality

Water quality could possibly be affected as a result of snowmobile exhaust emissions, as described under the draft plan. Effects would be somewhat greater than under the draft plan because of more projected use and increased trail mileage. The overall effect, however, would be insignificant.

#### Floodplains and Wetlands

The maximum access alternative would have no significant effect on floodplains and wetlands.

#### Cultural Resources

The use of approximately 178 miles of winter trails would have minimal effects on archeological resources. Other than cross-country ski trails, snowmobile trails, and portages in the vicinity of the Kettle Falls Historic District, trails would not be routed near historic structures or sites.

#### Visitor Use

Analysis. The maximum access alternative would improve and greatly expand snowmobiling opportunities. Total snowmobile trail and portage miles would increase from an existing 51.0 miles to 76.8 miles. Because access would be provided to the Chain of Lakes, Shoepack Lake, and Cruiser Lake, snowmobilers would continue to have opportunities to ice-fish and tour the peninsula. A new trail in the southeastern area of the park (from Rollick Creek to Net Lake) would provide an overland snowmobiling alternative to the Kabetogama Peninsula for resort guests at

Crane Lake and Ash River. Several small lakes would be accessible from the trail, but not Lucille Lake. Spur trails to high rock ridges in this area could provide views of the park landscape.

The construction of 90 miles of new cross-country ski trails would greatly expand opportunities for this type of activity. The new trails, along with the improvement of the Black Bay trail system, would provide a wide variety of opportunities for extended skiing and viewing of landscapes and wildlife.

The ski trail from Crane Lake to Kabetogama would provide a ski touring link between these two communities. The north-south Cruiser Lake ski trail would connect with the Crane Lake to Kabetogama trail and also the Kabetogama Peninsula ski trail. This trail network would allow for extended ski touring possibilities and opportunities for overnight stays at resorts or winter camping in the park from Crane Lake to the Rainy Lake visitor center, a 45-mile one-way distance. Five overnight cabins would be available along the ski trails and would be available on a reservation basis, as discussed under the draft plan. Resorts at Crane Lake, Ash River, and Island View would likely benefit from visitors who wanted a resort-to-resort skiing opportunity.

As described under the draft plan, noise generated by snowmobiles and trail maintenance equipment could adversely affect the experiences of some visitors. Because this alternative would provide the most extensive snowmobile trail system, the potential for snowmobile noise intrusions would be the most of any alternative. Noise from trail maintenance equipment, such as chain saws and brush-cutters during the summer season, would be insignificant.

Conclusion. The increased variety of trails for winter recreational activities would likely encourage more visitation by snowmobilers and skiers. Most areas of the park would be readily accessible to winter recreationists. Backcountry isolation and solitude, which some visitors consider to be important, could be reduced on the more popular trails, but overall the expanded trail systems would help disperse use and thus increase the possibility for solitude.

### Local Economy

Analysis. Under the maximum access alternative both skiers and snowmobilers from outside the local region would be expected to increase. The 178 miles of winter trails would provide the most extensive trail systems for both skiers and snowmobilers. However, as described under the draft plan, no firm projections can be made since the park has only been established for 12 years.

Compared to existing conditions, ski trail mileage would increase by 10 times. The construction of two major scenic trails, with overnight cabins, would offer additional attractions to skiers, and providing a trail on the south shore of Kabetogama Lake adjacent to the resorts would appeal to



local guests. The proposed trail near the Chain of Lakes would be a popular attraction because of its scenic qualities. Annual nonlocal use is projected to increase from 500 days to 6,500 days after 10 years, with annual expenditures increasing by \$240,000 (\$480,000 after reinvestment).

Snowmobile trail mileage would nearly double compared to the no-action alternative, and more scenic routes would be provided. These factors are projected to increase nonlocal use from 1,000 days to 6,000 days after 10 years, with annual expenditures increasing by an additional \$500,000 (\$1,000,000 after reinvestment).

The above projections are only estimates that are most useful for comparing alternatives. For planning purposes, this alternative might result in a total annual benefit to the local economy of \$1,480,000. This increase would be expected to occur 10 years after full implementation of this alternative. The increase in local income from expenditures by visitors from outside the region would represent new money to the economy. The various resorts would benefit equally from the projected skier expenditures. However, the increase in snowmobiler expenditures would primarily benefit the resort communities of Kabetogama, Ash River, and Crane Lake because of the location of the new trails. There would be no effect on park concessioners.

An additional impact would result from the one-time construction expenditure of \$1,948,800 and from the park's annual expenditure of \$164,000 for maintenance and \$127,600 for resource management and visitor protection.

Conclusion. Compared to present trends, full implementation of the maximum access alternative would increase nonlocal visits for skiing by nearly four times and for snowmobiling by two times over a 10-year period. This increased visitation could result in additional income to the local economy of \$1,480,000, benefiting local businesses and resorts. One-time construction expenditures could add \$1,948,800 to the economy; annual maintenance and management costs would be the highest of any alternative and would add \$291,600.

Table 5: Summary of Major Environmental Consequences--Winter Alternatives

	Draft Plan	No-Action Alternative	Minimum Access Alternative	Maximum Access Alternative
Vegetation	<p>Vegetation would be removed on 51.8 miles of new trails (79.6 acres). Annual maintenance of new and existing trails would affect 79.7 miles of trail (117.7 acres), or 0.06 percent of the park's land area. Vegetation would be permanently removed on 0.1 acre covered by structures; concentration of use around each structure would affect 1 acre of vegetation. No significant effect.</p>	<p>Annual maintenance of 27.9 miles of trail would affect 38.7 acres of vegetation, or 0.03 percent of the park's land area. No significant effect.</p>	<p>Vegetation would be removed on 11.2 miles of new trail (13.4 acres). Abandoning 10 miles of trail would allow 12 acres to revegetate. Annual maintenance of 28 miles of new and existing trails would affect 38.4 acres, or 0.03 percent of the park's land area. No significant effect.</p>	<p>Vegetation would be removed on 150.3 miles of new trails (206.6 acres). Annual maintenance of 178.2 miles of new and existing trails would affect 242.3 acres, or 0.18 percent of the park's land area. Vegetation would be permanently removed on 0.7 acre covered by structures; concentration of use around each structure would affect 2.3 acres total. No significant effect.</p>
Wildlife	<p>Construction, use, and maintenance of 79.7 miles of trail would affect approximately 4,124 acres of habitat parkwide (3.1 percent of the park's land area), including 3,222 acres on the Kabetogama Peninsula (4.3 percent of the peninsula's land area). Large areas of land on the Kabetogama Peninsula and southeastern portion of the park would not be affected by trail development or use. Trails would be built near the edges of the Kabetogama Peninsula and would closely skirt moose habitat and bisect one or more park wolf pack territories. No significant effect.</p>	<p>Use and maintenance of 27.9 miles of trails and use of 34.2 miles of unmaintained snowmobile routes would affect approximately 2,958 acres of habitat throughout the park (2.2 percent of the park's land area), including 2,643 acres on the Kabetogama Peninsula (3.5 percent of the peninsula's land area). Unmaintained snowmobile routes run down the center and across the Kabetogama Peninsula, further dividing habitat areas. No significant effect.</p>	<p>Construction, use, and maintenance of 28.0 miles of trail would affect approximately 1,411 acres of habitat (1.1 percent of the park's land area), including 509 acres on the Kabetogama Peninsula (0.7 percent of the peninsula's land area). Prohibiting overland snowmobiling on the Kabetogama Peninsula would offer the most protection from human disturbance to the park's wildlife population. No significant effect.</p>	<p>Construction, use, and maintenance of 178.2 miles of trail would affect approximately 8,842 acres of habitat (6.6 percent of the park's land area), including 4,774 acres on the Kabetogama Peninsula (6.3 percent of the peninsula's land area). A large proportion of habitat would be near trails or shorelines of major lakes. Trails would bisect two areas of moose habitat and all park wolf pack territories. Numbers of ungulates and wolves could potentially be reduced.</p>

Visitor Use	Draft Plan	No-Action Alternative	Minimum Access Alternative	Maximum Access Alternative
	<p>The overall snowmobiling experience would be improved with designated, maintained overland snowmobile trails, which would appeal to nonlocal visitors, create a slightly longer use season, and allow snowmobiling during poor ice years. Providing no snowmobile access to the Chain of Lakes or ice-fishing lakes would adversely affect the experience of some visitors. Skiers would have opportunities for long-distance and overnight trips.</p>	<p>Continuing existing conditions, particularly unmaintained snowmobile trails on the Kabetogama Peninsula, would provide a primitive type of experience and increase the potential for accidents if current use levels increased significantly. No additional skiing opportunities would be provided.</p>	<p>Prohibiting snowmobiling on the Kabetogama Peninsula would result in the loss of backcountry ice-fishing and scenic touring opportunities. Providing three separate ski trails in lieu of the Black Bay trail would reduce congestion and improve safety; no long-distance ski opportunities would be provided.</p>	<p>Snowmobilers would have the greatest access to scenic tours and recreational activities on the Kabetogama Peninsula of any alternative. A snowmobile trail in the southeastern portion of the park would enhance travel options for resort guests at Crane Lake and Ash River. Extensive ski trails would also provide the best touring opportunities for skiers, ranging from one-day to multiday trips.</p>
Local Economy	<p>Using increases under the no-action alternative as a base, nonlocal visits for skiing might double while snowmobiling use would nearly double. Resulting additional income to the local economy could also be double the no-action alternative. Total one-time construction expenditure of \$642,300; annual maintenance and management expenditures of \$179,500.</p>	<p>Based on existing use trends, nonlocal visits for skiing and snowmobiling could triple in 10 years. Possible additional income to local economy of \$512,000; annual maintenance and management expenditures of \$112,400.</p>	<p>Compared to the no-action alternative, nonlocal visits for skiing and snowmobiling would increase more slowly. Projected additional income to local economy would be about 25 percent less than under the no-action alternative. Total construction expenditure \$104,400; annual maintenance and management expenditures of \$112,200.</p>	<p>Using increases under the no-action alternative as a base, nonlocal visits for skiing might more than triple while snowmobiling use would double. Resulting income to the local economy could also be triple the no-action alternative. Total construction expenditure \$1,948,800; annual maintenance and management expenditures of \$291,600.</p>

Note: Effects on soils, water quality, air quality, floodplains, wetlands, and cultural resources would not be potentially significant under any alternative.

## SUMMER ALTERNATIVES

### DRAFT PLAN

Impacts of the draft plan for summer access would result from the limited expansion of trails for hiking, interpretation, handicapped access, and canoe portaging. A total of 94.4 miles of trail would be provided: 72.7 miles of hiking trail (an addition of 54.5 miles compared to existing conditions), 7.2 miles of interpretive trail (plus 2.5 miles), 5.1 miles of handicap-accessible trail (nothing now), and 9.4 miles of canoe portages (plus 5.1 miles). The total additional mileage would be 67.2.

### Soils

Analysis. The construction of 67.2 miles of new trail would affect 37.2 acres of soil. Excavation would be necessary in some areas; for example, cuts and fills would be required in areas of uneven terrain to ensure that trails were handicap accessible, and localized excavation for switchbacks on hills would be needed for hiking trails. Soil compaction along 94.4 miles of trail would affect 52.7 acres, with the primary effect being on vegetation, as described below.

Conclusion. The overall effect on soils as a result of construction and use would be insignificant.

### Vegetation

Analysis. The primary effects on vegetation would be the cutting of trees and brush for 67.2 miles of new trail corridor, which would affect 37.2 acres of forest vegetation. Use and maintenance of 94.4 miles of new and existing trails by annual brushing and clearing along the trail corridors (4 feet to 10 feet wide) would affect 52.7 acres (0.04 percent of the park land area). These activities would encourage replacement by rapidly growing herbaceous plants and shrubs, such as blueberry, raspberry, red tag alder, red osier dogwood, and beaked hazel. All new trails would be routed to avoid rare or unusual plant species and communities. A 2.0-mile loop trail would be eliminated from the Cruiser Lake trail system, allowing 1.0 acre to return to natural conditions and eventually resemble the surrounding forest, which is a mixture of aspen, birch, pine, oak, spruce, and fir.

The asphalt or boardwalk surface of handicap-accessible trails would exclude vegetation from the width of the tread.

Soil compaction on trail treadways would cause some damage to tree roots.

Exotic plants could continue to be brought into the park by means of trail traffic and maintenance and would become established in disturbed areas. Exotic plants represent about 10 percent of the plant species around backcountry campsites in the Boundary Waters Canoe Area Wilderness.



Conclusion. Trail construction, use, and maintenance would affect a total of 52.7 acres (0.04 percent of the park's land area). This would not be a significant effect.

## Wildlife

Analysis. Under the draft plan, the construction and maintenance of 94.4 miles of trail would directly affect a total of 52.7 acres of wildlife habitat, or 0.04 percent of the park's land area. During the summer, habitat would be affected by the removal of vegetation along trail corridors and disturbance of resting, feeding, and nesting wildlife along trail corridors and at interior lakes and ponds. Animals would not be as affected by disturbance in summer as in winter because in summer they are not under as much stress (except nursing mothers), foliage provides greater coverage, mobility is easier, and food resources are more abundant.

The removal of 52.7 acres of vegetation for the construction and maintenance of 94.4 miles of trail would have very localized effects on wildlife habitat and species abundance, and the effects would be the same as those described for the construction of winter trails. Removing selected overstory trees would decrease the habitat for cavity nesting birds and mammals, and decrease associated food sources. The removal of overstory trees would increase light penetration to the forest floor, allowing ground vegetation to grow and benefiting ground-dwelling wildlife. Larger wildlife species would also benefit from using the increased food resources associated with trail corridors and follow them as travel routes.

Closing and rehabilitating a 2.0-mile central loop trail on the south side of Cruiser Lake would have very localized effects on wildlife habitat and species abundance, particularly for invertebrates, birds, and small mammals. Canopy closure would gradually decrease light penetration to the forest floor, resulting in a decrease of ground vegetation and ground-dwelling wildlife. As overstory trees matured, food resources and nesting habitats for a variety of canopy-dependent wildlife species would increase.

Trails would be routed to provide park wildlife reasonable protection from human disturbance on the Kabetogama Peninsula and in the southeastern portion of the park. Wildlife would be temporarily displaced by human traffic within 200 feet of a trail. Impacts to animals would be minimal because in summer, as previously discussed, they generally are not under as much stress as during winter. The activity along 94.4 miles of trail would affect 4,578 acres of habitat, or 3.4 percent of the park's land area.

Wolves are sensitive to human disturbance when selecting a denning site, and at Isle Royale National Park they have avoided establishing any denning areas within 0.5 mile of a trail. Although this effect has not been documented at Voyageurs, it is probable that trail development could cause a reduction in available denning habitat proportional to the total

trail mileage. Following repeated human disturbance, wolves could move pups away from denning sites, thus exposing them to undue danger (Chapman 1979). Compared to existing conditions, an additional 67.2 miles of trail would be constructed, but much of the new trail development would be near shorelines or on islands, which would minimize effects on potential denning areas. Also loop trails would have less effect than linear trails because the effect would be confined to a smaller area. Still, potential displacement could increase with the net increase in trail mileage. Trail use under the draft plan would not affect wolf prey species or hunting behavior.

Bald eagles would not be directly affected by construction, use, or maintenance of trails. No trails would be built on islands or shorelines with known eagle nests. More boat traffic on the major lakes would increase the potential for human disturbance of nesting bald eagles along the shorelines. Bald eagles would continue to be monitored as part of the natural resource management program, and corrective actions would be taken as necessary to eliminate or minimize disturbances to nesting birds. Corrective actions would include closing and posting trail segments, small islands, or sections of shoreline around nests, and also instituting a visitor education program about the particular needs of this species.

Increased visitor access to and use of interior areas would result in more potential disturbance to nesting loons on interior lakes, which in the long term might reduce the size and productivity of the common loon population. The park would mitigate this impact by posting warning signs and closing selected areas to use.

Construction, use, and maintenance of park trails would have little effect on the park's 3,000 beavers. Trails generally would continue to be located on uplands away from beaver ponds, bogs, wetlands, and stream channels to minimize trail flooding due to dam construction. Flooding could occur on nature trails next to beaver ponds, which would give visitors an opportunity to view beavers in their natural habitat. In these cases the trail would either be raised or relocated.

Constructing additional park trails would stimulate more hiking and camping, therefore increasing the potential for conflicts between the park's 200 black bears and humans somewhat above current levels. However, this alternative would leave most of Voyageurs' 200 square miles of bear habitat inaccessible to people. It is unlikely that any encounters between black bears and visitors would result in attacks or injuries. Public education programs and bear-proof food storage facilities would continue to be provided in order to reduce human/bear conflicts.

Summer fishing pressure on the park's interior lakes, especially at Locator, Ek, and Cruiser lakes where visitors may reserve NPS canoes and rowboats, would be increased under this alternative because of improved trail access from the major lakes. Fishing pressure on the muskellunge population in the Shoepack Lakes would increase because of the construction of a canoe portage from Jorgens Lake. As described for the winter alternatives, many of Voyageurs' interior lakes are of low

productivity and may be easily overfished. Monitoring would be conducted as part of the natural resource management program, and management actions would be taken as necessary to protect fish populations.

Research and monitoring programs would be undertaken to document the effects of summer trail construction, use, and maintenance on the park's ungulate, predator, and scavenger populations. If research and monitoring revealed significant unanticipated impacts from a particular trail, that trail would either be temporarily closed, rerouted, or closed permanently and rehabilitated. Closed trails would require only a few years to revegetate because of high moisture availability in most of the park and a relatively long growing season.

Conclusion. A total of 4,580 acres of habitat, or 3.4 percent of the park's total land area, would be potentially affected by summer trail activities. Wolf denning and rendezvous sites, loon-nesting habitats, and fisheries on interior lakes could be affected by increased use. Disturbances would be mostly temporary and would not significantly affect wildlife survival.

Cumulative Effects on Wildlife. Other natural resource programs would affect park wildlife independently of trail development, and all actions must be considered in terms of cumulative effects on wildlife. Using managed fires to help return wildlife habitat to a higher level of productivity similar to pre-1890 conditions, increasing wildlife populations, and potentially reintroducing caribou and elk would all support significantly larger populations of predators and scavengers, particularly benefiting the threatened gray wolf and bald eagle. Compared to these programs, the draft trail plan would have negligible effects on wildlife in Voyageurs.

### Air Quality

Construction and maintenance activities would have minimal, localized effects on air quality if power tools were used. There would be no long-term effects on air quality.

### Water Quality

Trail construction and maintenance would have minimal effects on water quality locally where excavation occurred. Revegetation would quickly stabilize any disturbed soils, and erosion would be temporary. Increased visitor use and access could degrade water quality at trailheads and campsites. Visitors would be informed about proper sanitation techniques to reduce water pollution and would be advised to treat all drinking water. Toilets would be provided at popular trailheads and all campsites to reduce health hazards.

## Floodplains and Wetlands

Areas susceptible to flooding would not be adversely affected by construction, use, or maintenance of trails.

Rerouted portions of existing trails or new trails would not significantly affect wetlands or beaver ponds. Any trails flooded by new beaver ponds would be rerouted or replaced by elevated boardwalks; neither of these methods would affect wetland vegetation or hydrology. Beneficial effects of wetlands, such as summer wildlife habitat, open space, water storage, and water filtration, would be unaffected by trail construction, maintenance, and use.

## Cultural Resources

Providing 94.4 miles of hiking trails would have minimal effects on archeological sites and historic resources. Approximately 67.2 miles of new trail would be constructed or realigned. All existing and new trail alignments would be surveyed to determine the presence of archeological resources. Known sites have been avoided in selecting trail corridor alignments. Trailhead sites, in particular, would be carefully selected, evaluated, and surveyed before construction because use would be most concentrated at these sites and they would generally be near shorelines.

Archeological surveys would be conducted before any trail construction to avoid potential adverse effects. If artifacts or sites were identified, mitigating measures would be initiated, including recording and collecting artifacts or selecting an alternative trail alignment. Archeological evaluations and surveys would be scheduled by the Midwest Regional Office with the Midwest Archeological Center, in compliance with the provisions of the National Historic Preservation Act. Potential negative impacts on cultural resources would be mitigated in consultation with the Minnesota State Historic Preservation Office and the Advisory Council on Historic Preservation. In some cases trails could be routed to certain archeological or historic sites to facilitate interpretation of cultural resources.

Some illegal collection of cultural artifacts and damage to remains of historic buildings occurs. The significance of many of these sites is not known because they have not been inventoried. Most impacts occur at shoreline sites accessible by boat. It is not anticipated that the construction of additional trails would increase this problem.

## Visitor Use

Analysis. Visitor opportunities would be improved under the draft plan by constructing an additional 67.2 miles of trail, which would enhance hiking, backpacking, canoeing, fishing, and interpretive experiences for park visitors. Visitors without boats would have access to trails on the peninsula and other locations by means of shuttle boats, as proposed in the Master Plan.



Approximately 5.1 miles of handicap-accessible trails would be constructed at Blind Ash Bay, Kettle Falls, and the Rainy lake visitor center, providing new opportunities for this user group. Interpretive trails would be built at Blind Ash Bay and the Rainy Lake visitor center (the handicap trail at Rainy Lake would also serve as an interpretive trail).

Hiking and canoe portaging opportunities would continue along existing routes; minor design changes would correct access, potential safety, or resource impact problems. Fishing access would continue at Cruiser and Locator lakes. A new trail to Lucille Lake would add another backcountry fishing opportunity, and it would also provide park landscape views wherever the trail crossed or followed a high rock ridge. Constructing an additional 5.1 miles of canoe portages (for approximately 9.4 miles, the greatest amount of any alternative) would expand canoeing opportunities. Visitors could canoe across the Kabetogama Peninsula, from Cranberry Bay through the Chain of Lakes and the Shoepack Lakes to Eks Bay. A canoe portage from Kempton Bay to Shoepack Lake would offer another experience.

Trails accessible by roads (such as the Rainy Lake visitor center, Blind Ash Bay, and State Point) would provide nonboating visitors with hiking and interpretive opportunities that are not now available. The trail at Kettle Falls would provide hotel visitors and guests with more options for walks and short hikes.

Constructing loop trails on five islands would provide additional hiking opportunities for boaters. The additional trails would provide more occasions to see wildlife and view a greater variety of park landscapes. Trails accessible by boats on Kabetogama Lake would provide additional recreational hiking opportunities for visitors at resorts on the south shore as well as visitors using the Kabetogama boat launching areas.

Additional trails would encourage more park visitation and backcountry use, which could result in less backcountry solitude for some visitors, especially within a mile or two of trailheads, but the effect would be minor. Increased backcountry hiking could also result in more confrontations between humans and bears. The potential for injuries to humans and the need for subsequent control actions on bears could increase.

Additional visitation would increase the potential for litter, noise, and other signs of human use. These impacts could detract from some hikers' backcountry trail experiences and reduce feelings of isolation and solitude.

Conclusion. Trail use in the park would be enhanced by tripling hiking trails, doubling canoe portages, and providing handicap-accessible trails. Visitors would have access to a cross section of park environments and opportunities to view wildlife.

## Local Economy

Analysis. Under the draft plan an additional 67.2 miles of trails (compared to existing conditions) would be constructed. This would result in perhaps an additional 1,000 hikers per year, for a projected total of 15,900 hikers 10 years after full implementation of the draft plan. However, summer trail development would probably not directly affect visitor expenditures. Visitors generally do not come to Voyageurs to hike; they come for other reasons, primarily fishing and boating, and hiking is secondary to these other activities. Park tour boat concessioners could benefit if they carried more passengers to the Kabetogama Peninsula or islands to hike.

A one-time construction expenditure of \$3,867,800 would benefit the local economy during the trail-building period. The magnitude of this benefit would depend on which contractor successfully bid on the project, where he hired his work force, and what supplies and services he acquired locally. Additional benefits would accrue as local workers and businesses reinvested the income they received from the primary contractor.

An estimated \$96,500 would be expended annually for the maintenance of trails and other facilities. Such work would be done primarily by the park staff, but as much as 20 percent could be done by contractors or cooperating associations. An estimated \$105,200 would be spent annually for resource management and visitor protection. Most of the funds spent for maintenance and management would be in the form of salaries for local residents, and thus the local economy would benefit as these funds were spent. Unlike construction funds, this source of revenue would continue into the future.

Conclusion. Other than a one-time construction expenditure of \$3.7 million and annual maintenance and management costs of \$201,700, the effect on the local economy would be insignificant.

## MINIMUM ACCESS (NO-ACTION) ALTERNATIVE

Under the minimum access alternative limited improvement of existing hiking and canoe portage trails would be undertaken. Some trail sections could be rerouted, or boardwalks could be extended, in order to protect sensitive areas.

## Soils

Direct impacts on soils would result from the construction of 4.9 miles of interpretive trails (at the Rainy Lake visitor center, State Point, and Blind Ash Bay) and 10.2 miles of hiking trail at Kettle Falls, State Point, Cruiser Lake, and Lucille Lake. Constructing 15.1 miles of trail would affect 10.0 acres of soil. A 2-mile hiking loop on the south side of the Cruiser Lake trail system would be eliminated, allowing 1.0 acre to return to natural conditions. New trail construction would require little if any

excavation, other than grubbing an 18-inch treadway into mineral soil. Soil compaction along the trail tread would affect a total of 23.1 acres, with the primary effect being on vegetation.

### Vegetation

Analysis. Constructing 15.1 miles of new trail would affect 10.0 acres of vegetation because of tree cutting and brush removal along the trail corridor. A 2.0-mile loop would be eliminated from the Cruiser Lake trail, allowing 1.0 acre to return to natural conditions.

Maintaining 42.3 miles of new and existing trails by annual brushing and clearing would affect 24.4 acres of vegetation, or 0.02 percent of the park's land area. These actions would stimulate the growth of herbaceous and shrubby plants, as described under the draft plan. Soil compaction on trail treadways would cause some damage to tree roots, but the parkwide effect would be insignificant.

Conclusion. Construction, use, and maintenance of 42.3 miles of trail would affect 24.4 acres of vegetation, or 0.02 percent of the park's land area. The overall effect would be insignificant.

### Wildlife

Analysis. The construction, use, and maintenance of 42.3 miles of trail would directly affect 24.4 acres of wildlife habitat, or 0.02 percent of the park's land area, the smallest effect of any alternative. The habitat potentially affected within 200 feet on either side of 42.3 miles of trail would amount to 2,052 acres, or 1.5 percent of the park's land area.

Implementing this alternative would provide park wildlife on the Kabetogama Peninsula and in the southeastern portion of the park maximum protection from human disturbance. Very localized disturbance to deer, moose, black bears, small mammals, and birds in the immediate vicinity of trails, interior lakes, and ponds would remain at current levels or increase slightly with more visitation, although this would not be a significant effect in terms of wildlife populations or survival.

Most areas designated for summer trail development and use would be located within one or more territories of the park's five wolf packs. The potential reduction of wolf denning habitat would be the least under this alternative. The presence of 42.3 miles of park trails would have no additional effect on the prey populations wolves depend on, or on the hunting behavior of wolves.

Hiking and backpacking under this alternative would have little direct or indirect effect on bald eagles.

Increased use of interior lakes could potentially affect common loon nesting and brood-rearing habitat on interior lakes, and over the long

term the loon population size or reproduction rate could be reduced in the park's backcountry. The National Park Service would mitigate potential adverse effects by posting signs or closing areas to protect habitat.

Continued use and maintenance of hiking trails, interpretive trails, and canoe portages would have little effect on the park's 3,000 beavers. As described under the draft plan, flooded trail segments would either be raised or relocated.

Encounters between the park's 200 black bears and humans would continue at current levels, or could increase slightly with more use, but the potential for human injury would remain low. Under this alternative, however, most of Voyageurs' 200 square miles of bear habitat would not be accessible by trail.

Improved access and use of Lucille Lake could potentially affect the fishery resource. The National Park Service would monitor the resource and make appropriate changes in fishing regulations to protect it.

Conclusion. The minimum access alternative would offer the most protection to the park's wildlife populations. The potential for adverse effects would be minimal.

#### Air Quality

Air quality would not be significantly affected under the minimum access alternative.

#### Water Quality

Water quality would not be significantly affected.

#### Floodplains and Wetlands

Floodplains and wetlands would not be significantly affected.

#### Cultural Resources

The use of 42.3 miles of hiking trails would result in minimal impacts on archeological sites or historic structures. Only about 12.6 miles of trail would be new construction, and surveys would be conducted to locate any unknown archeological resources, as described for the draft plan.



## Visitor Use

Analysis. Hiking and canoe portaging opportunities would continue along existing routes; minor design changes would correct access, potential safety, or resource impact problems. Fishing access would continue at Cruiser and Locator lakes. The new trail to Lucille Lake would add another backcountry fishing opportunity, and it would provide excellent views of the park landscape in an area where the trail would cross or follow a high rock ridge. Approximately 5 miles of new interpretive trails (at Rainy Lake visitor center and Blind Ash Bay) and 10.2 miles of additional hiking trails (at State Point, Kettle Falls, Cruiser Lake, and Lucille Lake) would increase present interpretive and hiking opportunities for visitors in cars and also in boats. Trails accessible by roads, such as those at the Rainy Lake visitor center, Blind Ash Bay, and State Point, would provide nonboating visitors with hiking and interpretive opportunities that are not now available. The trail at Kettle Falls would provide hotel visitors and guests with more options for walks and short hikes. Visitors without boats would have access to trails on the peninsula and other locations by means of shuttle boats, as proposed in the park's Master Plan. Trails for handicapped visitors would not be provided, which would continue to discourage visitation by this user group.

Conclusion. Minor improvements and additions to the present trail system would enhance existing visitor experiences, but not for all categories of park visitors.

## Local Economy

Analysis. Summer visitor use would increase under the minimum access alternative as a result of existing growth trends. In 1985 approximately 5,900 visitors hiked. Under this alternative an additional 650 hikers per year would be expected 10 years after full implementation of the changes, for a projected total of 12,500 annual hikers. This growth in hiking would be attributed to the construction of the Rainy Lake visitor center and of visitor contact facilities on Kabetogama Lake, plus an increase in boat touring and shuttle services.

Even though this alternative would propose an increase of only 15.1 miles over existing conditions (as a result of improvements and realignments), the present trail network could easily accommodate any increase in hiking resulting from the above factors.

As discussed under the draft plan, an increase in hiking would result in only a small benefit to the local economy because visitors generally do not come to Voyageurs to hike. There would probably be no effect on park concessioners. The major impact would be due to trail construction and maintenance. One-time construction expenditures would be \$686,400, annual maintenance \$42,500, and resource management and visitor protection \$92,400.

Conclusion. Other than a one-time expenditure of \$686,400 for construction and annual maintenance and management costs of \$134,900, the minimum access alternative would have little effect on the local economy.

#### MAXIMUM ACCESS ALTERNATIVE

Under the maximum access alternative 123.9 miles of trail would be provided: 105.5 miles of hiking trail (an addition of 87.3 miles compared to existing conditions), 7.2 miles of interpretive trail (plus 2.5 miles), 5.1 miles of handicap-accessible trail (nothing now), and 6.1 miles of canoe portages (plus 1.8 miles). The total additional mileage would be 96.7. Impacts would be similar to those described for the draft plan and minimum access alternative.

#### Soils

The construction of 96.7 miles of new trail would affect 51.4 acres of soil. As described under the draft plan, an 18-inch treadway would be grubbed into mineral soil, and localized excavation would be necessary in some areas to ensure that trails were handicap accessible or to provide switchbacks. Soil compaction along the trail tread would affect 66.7 acres, with the primary effect being on vegetation. The overall effect would be insignificant.

#### Vegetation

Constructing 96.7 miles of new trail would directly affect 51.4 acres of forest vegetation. As described under the draft plan, the primary effect would be cutting trees and brush, which would stimulate rapidly growing shrubby and herbaceous plants.

Use and maintenance of 123.9 miles of trail would affect 66.7 acres, or 0.05 percent of the park's land area. Soil compaction on trail treadways would cause some damage to tree roots. The overall effect would be insignificant.

#### Wildlife

Analysis. Under the maximum access alternative there would be somewhat less protection for Voyageurs' wildlife populations than under the other two summer access alternatives. The removal of 66.7 acres of vegetation associated with constructing and maintaining a total of 123.9 miles of trail would have no significant effects on wildlife habitats and populations parkwide. As described under the draft plan, vegetation removal would have very localized effects on wildlife habitats and species abundance. The removal of overstory trees would decrease habitat for cavity nesting birds and animals, and it would increase light penetration to the forest

floor, thus stimulating the growth of grasses, forbs, and shrubs. The resulting increased diversity of food resources along trail corridors would benefit white-tailed deer, moose, and black bears.

Implementing the maximum access alternative would increase human presence, with possible disturbance of wildlife on the Kabetogama Peninsula and in the southeastern portion of the park, compared to the other alternatives. Very localized disturbance in the immediate vicinity of trails and campsites would increase proportionately with more trails and greater numbers of hikers. Human disturbance would slightly alter behavior of individual animals (including white-tailed deer, moose, black bear, small mammals, and birds) as they avoided encounters with people in the vicinity of trails and canoe portages, although this would not significantly affect overall wildlife populations or survival. A total of 6,009 acres of habitat, or 4.5 percent of the park's land area, would lie within 200 feet of either side of a trail.

Increased trail development could reduce suitable wolf denning and rendezvous sites, as described under the draft plan. Compared to existing conditions, an additional 96.7 miles would have a proportionately greater effect than what occurs now, and much of the new hiking trail mileage would be in currently undisturbed areas on the Kabetogama Peninsula. Neither wolf prey species nor wolf hunting behavior would be affected by trail use under the maximum access alternative.

Trail construction, use, and maintenance would have little direct effect on bald eagles. No trails would be built on islands or shorelines with known eagle nests. Indirect effects on bald eagles would continue as a result of boat traffic on the major lakes. As described under the draft plan, bald eagles would be monitored as part of the natural resource management program, and corrective actions would be taken as necessary to eliminate or minimize disturbances to nesting birds.

Construction, use, and maintenance of park trails would result in some localized disturbance of the park's 3,000 beavers. Trails would continue to be located primarily on uplands away from beaver ponds, bogs, wetlands, and stream channels so as to minimize trail flooding by beaver dams. However, the extensive nature of the trail system under this alternative, particularly on the Kabetogama Peninsula, would require the crossing of large expanses of lowlands between successive uplands. As described under the draft plan, in situations where beavers caused flooding, a trail would either be raised or relocated.

This alternative would have the greatest effect on the park's common loons, which nest on interior lakes, because of increased access and use. Loon nesting and brood-rearing habitat could be affected. Known nesting sites would be avoided in locating campsites and trails. The National Park Service would mitigate potential adverse effects by posting signs or closing areas to use.

The trail system under this alternative would increase the potential for encounters between the park's 200 black bears and humans above current

levels. Under this alternative trails would penetrate the 200 square miles of bear habitat that would be inaccessible under the other two alternatives. However, it would still be unlikely that a visitor would be attacked or injured by a bear. Public education programs and bear-proof food storage facilities would continue to be provided to reduce human/bear conflicts.

Summer fishing pressures on native and introduced fish species in the park's interior lakes would be increased under this alternative because of improved trail access. As described under the draft plan, lakes would be monitored to determine if they were being overfished, and mitigating actions would be taken as necessary.

Conclusion. The maximum access alternative would have a negligible overall effect on wildlife, but suitable wolf denning areas could be diminished, loon nesting and brood-rearing habitat reduced, and fishing pressure increased on some interior lakes.

#### Air Quality

Air quality could be temporarily and locally affected by trail construction and maintenance activities if power tools were used. There would be no long-term effects.

#### Water Quality

Trail construction and maintenance would have minimal effects on water quality locally where excavation occurred, as described for the draft plan. Revegetation would quickly stabilize any disturbed soils, and erosion would be temporary. Increased visitor use and access could degrade water quality at trailheads and campsites. Visitors would be informed about proper sanitation techniques to reduce water pollution and would be advised to treat all drinking water. Toilets would be provided at popular trailheads and all campsites to reduce health hazards.

#### Floodplains and Wetlands

Areas susceptible to flooding would not be adversely affected by construction, use, or maintenance of trails.

Due to the extensive construction under this alternative, trails would inevitably cross wetlands, but construction would not have a significant long-term effect. Trails would be on raised boardwalks, with no effects on hydrology or wetland vegetation.



## Cultural Resources

Under the maximum access alternative the use of approximately 124 miles of trails would have minimal effects on archeological sites or historic resources. A total of 96.7 miles of trail would be constructed or realigned; as described under the draft plan, alignments would be surveyed before construction to minimize the potential for adverse effects on unknown resources.

Potential new alignments on Rottenwood Island and at Lost Bay would be carefully evaluated to avoid adverse effects. As discussed under the draft plan, access to more areas of the park and greater visitor use could increase the likelihood of damage to cultural resources as a result of vandalism, illegal collection, or inadvertent disturbance.

## Local Economy

Analysis. The trail mileage under the maximum access alternative would be almost four times the existing network (123.9 mi compared to 27.2 mi). If this expanded system was coupled with vigorous marketing by the resorts, it could result in an additional 1,400 hikers per year, for a total of 19,900 hikers 10 years after full plan implementation. This increase in use would result in only a small benefit to the local economy because visitors generally do not come to Voyageurs to hike. The park's tour boat concessioners could benefit if they transported additional hikers to trails on the Kabetogama Peninsula or islands.

The major economic effect on the local community would be the park's one-time expenditure of \$5,091,300 for construction, \$125,800 for annual maintenance, and \$116,400 for annual resource management and visitor protection.

Conclusion. The major economic effect would be a one-time construction expenditure of approximately \$5.1 million. Annual maintenance and management expenditures of \$242,200 would have a minor effect. No additional visitor expenditures are projected as a result of trail development.

Table 6: Summary of Major Environmental Effects--Summer Alternatives

	Draft Plan	Minimum Access (No-Action) Alternative	Maximum Access Alternative
Soils	Constructing 67.2 miles of new trails would affect 37.2 acres of soils. New trails would be grubbed into mineral soil. Localized excavation would be required for interpretive trails, including handicapped accessible trails. Soils within treadways would be compacted by use, with the primary effect on vegetation. No significant effect.	Constructing 15.1 miles of new interpretive and hiking trails would affect 10.0 acres of soils; eliminating a 2-mile loop trail would remove impacts from 1.0 acre. Impacts would be the same as for the draft plan. No significant effect.	Constructing 96.7 miles of new trails would affect 51.4 acres of soils. Impacts would be the same as for the draft plan. No significant effect.
Vegetation	Vegetation would be removed on 67.2 miles of new trails (37.2 acres), affecting primarily rapidly growing herbaceous plants, shrubs, and saplings. Annual maintenance of 94.4 miles of existing and new trails would affect 52.7 acres of vegetation (0.04 percent of the park's land area). No significant effect.	Vegetation would be removed on 15.1 miles of new trails (10.0 acres) and restored on 2 miles (1.0 acre). Annual maintenance of 42.3 miles of new and existing trails would affect 24.4 acres of vegetation (0.02 percent of the park's land area). No significant effect.	Vegetation would be removed on 96.7 miles of new trails (51.4 acres). Annual maintenance of 123.9 miles of existing and new trails would affect 66.7 acres (0.05 percent of the park's land area). No significant effect.
Wildlife	Construction and maintenance of 94.4 miles of trails would directly affect 52.7 acres of habitat (0.04 percent of the park's land area); use would temporarily disturb wildlife on 4,578 acres of habitat (3.4 percent of the park's land area). Vegetation removal would have very limited effects on wildlife habitat. Improved access to interior lakes could potentially reduce the loon and fish populations. Abundant food sources and dense screening during summer would minimize adverse effects. Wolves would likely avoid areas within 0.5 mile of a trail as unsuitable denning and rendezvous sites. No overall significant effect.	Construction and maintenance of 42.3 miles of trails would directly affect 24.4 acres of habitat (0.02 percent of the park's land area); use would temporarily disturb wildlife on 2,052 acres of habitat (1.5 percent of the park's land area). Improved access to interior lakes could potentially reduce the loon and fish populations. Impacts would be similar to the draft plan, but less extensive. No significant effect.	Construction and maintenance of 123.9 miles of trails would directly affect 66.7 acres of habitat (0.05 percent of the park's land area); use would temporarily disturb wildlife on a total of 6,009 acres of habitat (4.5 percent of the park's land area). Improved access to interior lakes could potentially reduce the loon and fish populations. Potential reduction of suitable wolf denning and rendezvous sites, otherwise no significant effect.

	Draft Plan	Minimum Access (No-Action) Alternative	Maximum Access Alternative
Visitor Use	<p>Tripling the amount of hiking trails (compared to existing conditions), doubling canoe portages, and providing handicap-accessible trails would enhance all trail-related use in the park. Visitors would have more opportunities to see wildlife and various park landscapes.</p>	<p>Improving existing trails and building two additional interpretive trails would allow optimum use of the present trail system. Lack of handicap-accessible trails would discourage use by these visitors.</p>	<p>Quadrupling the amount of hiking trails (compared to existing conditions) would greatly expand opportunities for long-distance hiking and backpacking. Other types of trails and opportunities, as well as impacts, would be the same as the draft plan, except fewer canoe portages would be built.</p>
Local Economy	<p>Visitor use would be expected to increase by 1,000 hikers per year, for a total of 15,900 hikers in 10 years. Because hiking is secondary to other summer recreational activities (fishing and boating), the effect on visitor expenditures would be insignificant. A one-time construction cost of \$3,867,800 and annual maintenance and management expenditures of \$201,700 would benefit the local economy.</p>	<p>Based on present trends, visitor use would increase by an additional 650 hikers per year, for a total of 12,400 hikers in 10 years, with an insignificant effect on the local economy. A one-time construction expenditure of \$686,400 and annual maintenance and management expenditures of \$134,900 would benefit the local economy.</p>	<p>Visitor use would be expected to increase by 1,400 hikers per year, for a total of 19,900 hikers in 10 years, with a minimal effect on the local economy. A one-time construction expenditure of \$5,091,300 and annual maintenance and management expenditures of \$242,200 would benefit the local economy.</p>

Note: Effects on air quality, water quality, floodplains, wetlands, and cultural resources would not be potentially significant under any alternative.

## CONSULTATION AND COORDINATION

The identification of planning issues and management concerns for a Voyageurs National Park trail plan was begun during the winter of 1984-85. Initial public involvement meetings for the trail plan were held in September 1985, a Planning Alternatives Workbook was released in May 1986, and public meetings on the alternatives were held in June 1986. Throughout this time planning team members met or talked with various governmental agencies, consultants, and business interests about the plan. These contacts are briefly described below, followed by a description of public involvement to date.

### CONTACTS WITH OTHER AGENCIES AND CONSULTANTS

Timothy Knopp of the University of Minnesota met with team members in January 1985 regarding winter recreational demand, especially cross-country skiing.

On November 18, 1985, the planning team met with representatives of the Minnesota Department of Natural Resources to discuss winter and summer recreational activity trends and trail use throughout the state.

Various resort and private businesses in the Voyageurs area were contacted in the summer and fall of 1985 to determine local and regional trends in tourism and the local economy.

Contacts regarding effects of trail development and use on wildlife included Rolf Peterson, Michigan Technical University (recreational impacts on wolves, May 30, 1987); Durwood Allen, Purdue University (wolves and the status of scientific research, June 4, 1987); and David Mech, U.S. Fish and Wildlife Service (status of wolf studies and potential recreational impacts, June 4, 1987).

A copy of the Planning Alternatives Workbook was sent to the U.S. Fish and Wildlife Service in June 1986. Because trail development could affect two threatened species, the bald eagle and the gray wolf, the Fish and Wildlife Service requested that the National Park Service include a biological assessment in the environmental assessment for the trail plan (see appendix C for the agency's letter).

### PUBLIC INVOLVEMENT IN TRAIL PLANNING

The initial workshops to discuss trail planning for Voyageurs National Park were held during September 1985 in International Falls, Crane Lake, and St. Paul. A variety of issues relating to hiking, cross-country skiing, and snowmobiling were discussed, and much of the discussion focused on winter activities rather than summer activities.



For snowmobiling many people said they wanted a land-based trail system that would complement the lake routes, with continued maintenance of safety portages. Trails on the Kabetogama Peninsula should be tied into existing trails west of the park by means of a bridge at Gold Portage. However, some people said that existing snowmobiling opportunities are adequate and that no additional access should be provided on the peninsula, or possibly a route on the south side of the park should be considered in lieu of one on the peninsula. Some felt that lake routes should be marked, possibly with reflector-type signs or brightly painted poles. There were also requests for picnic shelters with fire rings along snowmobile trails. Maintenance standards should include a 12-foot groomed surface width, with adequate signing of curves, intersections, and other potential hazards.

Supporters of cross-country skiing wanted an extended trail system the length of the Kabetogama Peninsula, or a long trail that could be used for multiday trips, and also a trail to connect resort communities on the southern edge of the park. Trails should be packed and groomed, and the more accessible trails should also be tracked. Shelters could be placed at intersections of ski and snowmobile trails to serve both types of users.

Those people who specifically mentioned hiking said that more trails should be accessible by roads. Self-guided nature trails and more loop trails of varying lengths should be provided. A trail network could be developed the length of the Kabetogama Peninsula.

Based on these public comments, the proposals of the Master Plan, and a preliminary analysis of environmental considerations, a Trail Plan Alternatives workbook was released for public review in May 1986. Six alternatives were presented, three for winter use and three for summer. Public comments were solicited during public meetings held June 17-19, 1986, in International Falls, Crane Lake, and St. Paul. A mailback response sheet was also included in the workbook, and people were asked to comment by August 31, 1986. Comments made at the public meetings ranged from a need to expedite trail development to a need for more environmental information before a decision was made about developing any trails, particularly winter trails. Comments about snowmobile trails were nearly equally divided between desires for additional trails and statements that the environment is too fragile to support any such use. Cross-country skiers generally cited a need for more ski trails. There were many questions about the schedule for trail development and concerns about the effects of development and use on wildlife and the natural setting of the park (particularly on the Kabetogama Peninsula). People were also concerned about what effect trail development would have on the local economy and especially resorts. Very few public comments were made about summer trail development.

A total of 79 mailback response sheets were received by the park. Comments on winter trails were more expressive and diverse than comments about summer trails. The comments are summarized below.

### Winter Trail Alternatives

Concerns most often expressed related to environmental compatibility of trails, aesthetics, recreational opportunities, economic benefits, and enjoyment of the park.

Minimum Access Alternative--The minimum access alternative for winter was supported by 43 percent of the commenters (34 individuals). These people generally thought snowmobiles were environmentally or aesthetically incompatible with the purposes of this national park, particularly on the Kabetogama Peninsula. Many felt that snowmobile trails outside the park made it unnecessary to develop trails inside the park. Some commenters favored the development of more ski trails than would be provided under this alternative because they are not as incompatible as snowmobile trails and more skiing opportunities are needed.

NPS Preferred Alternative--Thirty percent of the commenters (24 individuals) favored the preferred alternative because it would formalize or expand present snowmobiling opportunities in the park. Anticipated economic benefits were also mentioned. Fewer specific comments were made about ski trails.

Maximum Access Alternative--This alternative was supported by 24 percent of the commenters (19 individuals), basically because of economic benefits and additional recreational opportunities.

Three percent of the commenters did not support a specific alternative.

### Summer Trail Alternatives

Most of the comments about summer alternatives clearly supported one alternative or another.

Minimum Access Alternative--Twenty-five percent of the commenters (20 individuals) favored the minimum access alternative because of preservation reasons (some thought it was undesirable to add more man-made intrusions in a natural area, particularly on the Kabetogama Peninsula) or practicality and cost-effectiveness (they thought very few visitors would take advantage of additional hiking trails owing to the discomfort caused by black flies and mosquitoes).

NPS Preferred Access Alternative--The preferred alternative was supported by 35 percent of the commenters (28 individuals). Of those commenters who specified their reasons for favoring this alternative, most cited improved opportunities to enjoy the park and the benefits to the surrounding communities from more visitors.

Maximum Access Alternative--This alternative was favored by 27 percent of the commenters (21 individuals) because it provided

additional recreational opportunities and could economically benefit the surrounding communities.

Ten individuals did not favor any one alternative.

The alternatives presented in this Draft Trail Plan and Environmental Assessment are based on the alternatives that were included in the alternatives workbook. As previously described, a no-action alternative has been added for winter use to serve as a basis for comparing alternatives. Other changes were made as a result of environmental analyses of the various trail alignments. Public comments and concerns were also taken into account as the alternatives and draft plan were refined.

#### REVIEW OF THE DRAFT TRAIL PLAN AND ENVIRONMENTAL ASSESSMENT

Copies of this document will be sent to the following governmental agencies and local groups for review:

##### Federal Agencies

Advisory Council on Historic Preservation  
Department of Agriculture  
    Forest Service, Superior National Forest  
Department of the Interior  
    Bureau of Indian Affairs  
    Fish and Wildlife Service  
    Geological Survey  
    Regional Solicitor

##### Minnesota State Agencies

Citizens' Council on Voyageurs National Park  
Department of Economic Development  
Department of Economic Security  
Department of Natural Resources  
Department of Transportation  
Historical Society  
State Historic Preservation Officer  
State Planning Agency

##### Other

Arrowhead Regional Development Commission  
Koochiching County Planning Commission  
St. Louis County Planning Commission  
Ontario Ministry of Natural Resources  
    Fort Frances District  
    Atikokan District  
    Quetico Provincial Park





## APPENDIX A: TRAIL MAINTENANCE AND CONSTRUCTION STANDARDS

### WINTER TRAILS

Cross-Country Ski Trails. Cross-country ski trails will be constructed with maximum grades not exceeding 12 percent. Brushing will be performed once a year or as necessary to maintain a 10-foot width and a 12-foot height. Ski trails will be groomed and tracked only as needed during the ski season.

Snowmobile Trails. Grades on snowmobile trails will not exceed 15 percent. Brushing along two-way sections will be done to maintain approximately a 12-foot width and 12-foot height. Along one-way sections, brushing will maintain corridors approximately 8 feet wide and 12 feet high. Trails will be groomed and packed as needed to maintain a smooth firm surface. Snowmobile trails will be designed to encourage a slow, resource-oriented experience. The maximum speed limit on trails will be 25 mph.

Snowmobile Safety Portages. Existing safety portages will continue to be maintained as two-way corridors. Grooming and brushing standards as stated above will be maintained. Signs and markers will be used as necessary.

Snowmobile Lake Routes. Snowmobile routes on major lakes may be marked for safety reasons to help visitors find the route. Traffic on the lakes will not necessarily be restricted to these marked routes, except in areas where safety is an issue (for example, near thin or unstable ice or areas of ice ridges).

### SUMMER TRAILS

Fluctuating lake levels must be considered in providing public access to certain trailheads during seasonal low water. Floating docks will need to be carefully situated and trails properly aligned to serve them. Also, docks must serve the needs of shuttle and tour boats.

Prescribed natural fires may inadvertently destroy shelters and boardwalks, but they may also enhance the variety of scenes viewed from trails.

The construction of beaver dams in many areas of the park have flooded boardwalks and formerly dry sections of trail. Beaver activity will always affect trail location and maintenance in low areas.

Backcountry Hiking Trails. Hiking trails will be dirt or smooth rock surfaced, with treadways approximately 18 inches wide; prolonged maximum grades will not be more than 15 percent. Trails will be brushed 4 feet wide and 8 feet high. Markers or cairns will be used along sections where the designated trail is not apparent. Planking or small

wooden bridges at least 12 inches wide will be used in wetland and bog areas as necessary.

Canoe Portages. Canoe portages will be brushed 4 feet wide and 10 feet high. Planking in wetland sections will be at least 24 inches wide. Canoe rest stands will be provided on longer portage routes.

Interpretive Trails. Interpretive trails will be constructed as high-standard foot trails suitable for guided interpretive walks. They will have hard-packed dirt or gravel treadways approximately 24 inches wide, with a prolonged maximum grade not exceeding 12 percent. These trails will be brushed 8 feet wide and 12 feet high. Wooden planking at least 4 feet wide may be used in wet areas. This type of trail could also be used as a cross-country ski trail in winter.

Handicap-Accessible Trails. These trails will be constructed as high-standard foot trails designed for large numbers of pedestrians, including visitors in wheelchairs. The treadways will be relatively level, smooth, and barrier free. These trails would be either paved or planked, with a minimum 6-foot width. Maximum prolonged grade will not exceed 5 percent. Brush will be cleared 10 feet wide and 12 feet high. In some places, such as the Rainy Lake visitor center, handicap trails will also serve as segments of interpretive trails for visitors who are not handicapped.

# APPENDIX B: COST ESTIMATES

Table B-1: Trail Construction and Maintenance

	Winter Alternatives					
	Draft Plan			No-Action Alternative		
	Construction Miles	Gross Cost	Annual Maintenance Miles	Construction Miles	Gross Cost	Annual Maintenance Miles
Preconstruction Surveys						
Type D (Ski trail)	22.4	\$ 74,600	32.4	10.0	\$ 5,800	11.2
Type E (1-way snowmobile)	21.4	242,900	21.4	17.9	17,900	16.8
Type E (2-way snowmobile)	8.0	119,800	25.9			
Total*	51.8	\$642,300	79.7	27.9**	\$23,700	28.0
					\$104,400	\$23,300
						178.2
					\$1,948,800	\$164,000

## Summer Alternatives

	Draft Plan					
	Minimum (No-Action) Alternative			Maximum Access Alternative		
	Construction Miles	Gross Cost	Annual Maintenance Miles	Construction Miles	Gross Cost	Annual Maintenance Miles
Reconstruction Surveys						
Type A (Handicap)	5.1	\$ 96,800	5.1	5.1	\$ 139,300	5.1
Type B (Interpretive)	2.5	1,045,000	7.2	2.5	1,045,000	7.2
Type C (Recreational)	59.6	2,575,900	82.1	89.1	3,756,900	111.6
Total*	67.2	\$3,867,800	94.4	96.7	\$5,091,300	123.9
						\$125,800

Note: Gross costs include 31 percent of net costs for contingencies and project supervision, plus 25 percent for advance and project planning.

\*Total includes the cost of any support facilities, such as lunch shelters, overnight cabins, and docks.

\*\*No snowmobile routes (other than safety portages) would be maintained.

Table B-2: Annual Resource Management and Visitor Protection Expenditures

	<u>Winter Alternatives</u>					
	<u>Draft Plan</u>		<u>No-Action</u>		<u>Minimum Access</u>	
	<u>Miles</u>	<u>Cost</u>	<u>Miles</u>	<u>Cost</u>	<u>Miles</u>	<u>Cost</u>
Wildlife Management		\$ 52,000		\$52,000		\$ 52,000
Fisheries Management		28,100		28,100		28,100
Trail Management	79.7	4,900	27.9	1,700	28.0	1,700
Visitor Protection	79.7	16,500	27.9	6,900	28.0	7,100
Total		\$101,500		\$88,700		\$88,900
						\$127,600

	<u>Summer Alternatives</u>					
	<u>Draft Plan</u>		<u>Minimum Access</u>		<u>Maximum Access</u>	
	<u>Miles</u>	<u>Cost</u>	<u>Miles</u>	<u>Cost</u>	<u>Miles</u>	<u>Cost</u>
Wildlife Management		\$ 52,000		\$52,000		\$ 52,000
Fisheries Management		28,100		28,100		28,100
Trail Management	94.4	5,900	42.3	2,600	123.9	7,700
Visitor Protection	94.4	19,200	42.3	9,700	123.9	28,600
Total		\$105,200		\$92,400		\$116,400



## APPENDIX C: CONSULTATION WITH THE FISH AND WILDLIFE SERVICE

### United States Department of the Interior

FISH AND WILDLIFE SERVICE  
ST. PAUL FIELD OFFICE, (ES)  
50 Park Square Court  
400 Sibley Street  
St. Paul, Minnesota 55101

July 1, 1986

#### Memorandum

To: Regional Director, National Park Service, Omaha, NE

From: Supervisor, FWS, St. Paul Field Office, St. Paul, MN (HR)

Subject: Section 7 Consultation on Trail Plan at Voyageurs National Park

From our review of the materials provided in your June 11, 1986 letter, the National Park Service (NPS) has correctly identified the three federally listed threatened or endangered species that occur within Voyageurs National Park (VNP). These species include the bald eagle, gray wolf, and peregrine falcon.

While the peregrine falcon is a transient to the project area, we believe this action will not affect this species. Considering the distribution and biology of the two former species, the Fish and Wildlife Service (FWS) concurs with your "may affect" determination for the bald eagle and gray wolf. Both of these species occur within VNP and may be adversely affected by proposed trail construction and subsequent public use. Therefore, in accordance with Section 7(c) of the Endangered Species Act of 1973 as amended, we recommend the NPS conduct a biological assessment to identify potential impacts to listed species. The biological assessment can be included as part of the Environmental Assessment (EA) proposed for this project and should discuss such topics as bald eagle/gray wolf density and distribution within VNP, potential impacts to prey species, and anticipated impacts resulting from trail construction and subsequent use. In addition, we recommend a discussion be presented relative to existing trail use in and adjacent to VNP, public demand for additional trails, and anticipated future use. While actual trail routing and construction will affect listed species, secondary effects associated with human use, i.e., motorized/non-motorized, must also be addressed. These data will provide a overview of existing conditions and provide a basis from which recommendations can be made.

Upon completion of the EA, please provide a copy to this office for our review. At that time, the NPS may also request to initiate formal consultation with the FWS relative to Section 7 of the Act. Should you have any questions concerning the Section 7 consultation process, please contact Mr. Jim Leach of my staff at your convenience.



Robert F. Welford

cc: MN DNR, International Falls



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE PATUXENT WILDLIFE RESEARCH CENTER

U. S. Fish & Wildlife Service  
C/o North Central Forest Exp. Stn  
Folwell Ave.  
St Paul, Minnesota 55108

April 29, 1987

Mr. Russell W. Berry, Jr., Superintendent  
Voyageurs National Park  
P. O. Box 50  
International Falls, MN 56649

Dear Mr. Berry:

I have reviewed your draft wolf management document for Voyageurs National Park, and I believe that Alternative B would insure adequate attention and protection of the wolf.

I know of no evidence, or reason to believe, that snowmobiling, summer or winter visitor use, winter camping, or other winter sports will have a detrimental effect on the survival of your wolf population. Wolves' avoidance of well used human trails should cause them no real inconvenience nor should it interfere with their hunting. The only reference cited to document the effect of human disturbance on wolves (Chapman 1979) pertains to denning on the north slope of the Brooks Range in completely open, treeless terrain. I am personally familiar with the den studied by Chapman (who is now my graduate student), and it is situated entirely differently from those in Minnesota. We know of several wolf dens and rendezvous sites in Minnesota which people have regularly come within less than one-quarter mile of without causing abandonment.

Regarding restoring fire, caribou and elk to your ecosystem, and increasing public information, these certainly would be advantageous to wolves, and I would like to see these proposals considered more seriously. Perhaps some modification of Alternative B that gives greater weight to these proposals, without all the other monitoring proposed in Alternative C, could be forged.

As a wolf researcher I am uncomfortable not supporting as much wolf research as possible. However, I cannot in good conscience do so in this case because I do not believe the situation requires it, and the reasons given in the document do not justify it.

Sincerely,

L. DAVID MECH  
Wildlife Research Biologist

Note: Alternative references are to the park's *Draft Natural Resource Management Plan*. Ed.





## SELECTED BIBLIOGRAPHY

- ADAMS, EVELYN S.  
1975 "Effects of Lead and Hydrocarbons from Snowmobile Exhaust on Brook Trout (Salvelinus fontinalis)." Transactions of the American Fisheries Society, no. 2, pp. 363-73.
- ADELMAN, B.J.E., T.A. HEBERLEIN, AND T.M. BONNICKSEN  
1982 "Social Psychological Explanations for the Persistence of a Conflict between Paddling Canoeists and Motorcraft Users in the Boundary Waters Canoe Area." Leisure Sciences 5(1):45-61.
- AHLGREN, CLIFFORD E.  
1959 "Some Effects of Fire on Forest Reproduction in Northeastern Minnesota." Journal of Forestry 57:194-200.  
  
1976 "Regeneration of Red Pine and White Pine Following Wildfire and Logging in Northeastern Minnesota." Journal of Forestry 74:135-40.
- AUNE, KEITH E.  
1981 "Impacts of Winter Recreation on Wildlife in a Portion of Yellowstone National Park." M.S. Thesis. Montana State University, Bozeman.
- BOLLINGER, JOHN G., ORRIN J. RONGSTAD, AND ANDRES SOON  
1973 Snowmobile Noise Effects on Wildlife. Engineering Experiment Station, University of Wisconsin, Madison.
- BURY, RICHARD L.  
1978 "Impacts of Snowmobiles on Wildlife." Transactions of the 43rd North American Wildlife and Natural Resource Conference 43:149-56.
- BURY, R.L., R.C. WENDLING, AND S.F. McCOOL  
1976 Off-Road Recreation Vehicles--A Research Summary, 1969-1975. Agricultural Experiment Station, Texas A&M University.
- CARBYN, L.N.  
1983 "Incidence of Disease and Its Potential in the Population Dynamics of Wolves in Riding Mountain National Park, Manitoba." In Wolves of the World, edited by F.H. Harington and P.C. Paguet, 106-16. Park Ridge, NJ: Noyes Publishers.
- CHAPMAN, R.C.  
1979 "Human Disturbance at Wolf Dens - A Management Problem." Proceedings of the First Conference on Scientific Research in the National Parks. 323-28.

COFFMAN, M.S., L. RAKESTRAW, AND J.E. FERRIS

- 1980 "The Fire and Logging History of Voyageurs National Park." Prepared for the National Park Service. Michigan Technical University, Houghton, MI.

COLE, GLEN F.

- 1977 "A Naturally Regulated Elk Population." Proceedings, Symposium on Natural Regulation of Wildlife Numbers. The Northwest Section, the Wildlife Society meeting in Vancouver, B.C. (in press).
- 1981 "Alternative Hypotheses on Ecological Effects of Meningeal Parasite (Parelaphostrongylus tenuis)." Journal of the Minnesota Academy of Science 47:8-9.
- 1982 "Current Challenges in Resource Management: Restoring Natural Conditions in a Boreal Forest Park." Transactions of the 47th North American Wildlife and Natural Resources Conference, pp. 411-19.
- 1987 "Changes in Interacting Species with Disturbance." Environmental Management 11(2):257-64.

DEVALL, B., AND J. HARRY

- 1981 "Who Hates Whom in the Great Outdoors: The Impact of Recreation Specialization and Technologies of Play." Leisure Sciences 4(4):399-418.

DORRANCE, MICHAEL J., PATRICK J. SAVAGE, AND DAN E. HUFF

- 1975 "Effects of Snowmobiles on White-tailed Deer." Journal of Wildlife Management 39(3):563-69.

EASTERN TIMBER WOLF RECOVERY TEAM

- 1981 Recovery Plan for the Eastern Timber Wolf. Marquette, MI.

ECKSTEIN, RONALD G., THOMAS F. O'BRIEN, ORRIN J. RONGSTAD, AND JOHN G. BOLLINGER

- 1979 "Snowmobile Effects on Movements of White-tailed Deer: A Case-study." Environmental Conservation 6:45-51.

FERGUSON, MICHAEL A., AND LLOYD B. KEITH

- 1982 "Influences of Nordic Skiing on Distribution of Moose and Elk in Elk Island National Park, Alberta." Canadian Field Naturalist 96:69-78.

FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE

- 1964 "The Recreational Capacity of the Quetico-Superior Area," by R.C. Lucas. Report LS-15, Lakes States Forest Experiment Station, St. Paul, MN.
- 1971a Ecological Studies of the Timber Wolf in Northeastern Minnesota, edited by L. David Mech and L.D. Frenzel, Jr. Research Paper NC-52. North Central Forest Experiment Station, St. Paul, MN.

- 1971b Wilderness Ecology: Virgin Plant Communities of the Boundary Waters Canoe Area, by L.F. Ohmann and R.R. Ream. Research Paper NC-63. North Central Forest Experiment Station, St. Paul, MN.
- 1973a Wilderness Ecology: The Upland Plant Communities, Woody Browse Production, and Small Mammals of Two Adjacent 33-year-old Wildfire Areas in Northeastern Minnesota, by L.F. Ohmann, C.T. Cushwa, R. E. Lake, J.R. Beer, and Robert B. Brander. General Technical Report NC-7. North Central Forest Experiment Station, St. Paul, MN.
- 1973b Wolf Numbers in the Superior National Forest of Minnesota, by L. David Mech. Research Paper NC-97. North Central Forest Experiment Station, St. Paul, MN.
- 1985 "Recreational Trampling Effects on Six Habitat Types in Western Montana," by D.N. Cole. Research Paper INT-350. Intermountain Research Station, Ogden, UT.
- 1986 Record of Decision, Final Environmental Impact Statement, Land Resources Management Plan, Superior National Forest. Eastern Region, Milwaukee, WI.
- FRAZIER, J.D., L.D. FRENZEL, AND J.E. MATHISEN
- 1985 "The Impact of Human Activities on Breeding Bald Eagles in North-central Minnesota." Journal of Wildlife Management 49(3):585-92.
- FREDDY, DAVID J., WHITCOMB BRONAUGH, AND MARTIN C. FOWLER
- 1986 "Responses of Mule Deer to Disturbance by Persons Afoot and Snowmobiles." Wildlife Society Bulletin 14:63-8.
- FRISSELL, S.S.
- 1973 "The Importance of Fire as a Natural Ecological Factor in Itasca State Park, Minnesota." Journal of Quaternary Research 3: 397-407.
- GRAEFE, A.R., J.J. VASKE, AND F.R. KUSS
- 1984 "Social Carrying Capacity: An Investigation and Synthesis of 20 Years of Research." Leisure Sciences 6(4):395-431.
- HARDWIG, J.T.
- 1978 "Timber Wolf (Canis lupis) Food Habits in Voyageurs National Park." Prepared for the National Park Service by Rainy River Community College, International Falls, MN.
- HEBERLEIN, T.A., AND B. SHELBY
- 1977 "Carrying Capacity, Values, and the Satisfaction Model." Journal of Leisure Research 9(1):142-48.

HEINSELMAN, M.L.

- 1970 "Landscape Evolution, Peatland Types, and the Environment in the Lake Agassiz Peatlands Natural Area, Minnesota." Ecological Monographs 40:235-61.
- 1970 "Restoring Fire to the Ecosystems of the Boundary Waters Canoe Area, Minnesota." Proceedings of Tall Timbers Fire Ecology Conference No. 10. Tallahassee, FL.
- 1973 "Fire in the Virgin Forests of the Boundary Waters Canoe Area, Minnesota." Journal of Quaternary Research 3:329-82.

HUFF, DAN E., AND PATRICK J. SAVAGE

- 1972 "A Correlation of Deer Movements with Snowmobile Activity in Minnesota during Winter, 1972." Paper presented to the 34th Midwest Fish and Game Wildlife Conference, Des Moines, IA.

INTERNATIONAL SNOWMOBILE INDUSTRY ASSOCIATION

- 1976 Snowmobiling and Our Environment - Facts and Fantasies.
- 1985 Snowmobiling Fact Book.

IRWIN, L.L.

- 1975 "Deer-Moose Relationships on a Burn in Northeastern Minnesota." Journal of Wildlife Management 39:653-62.

KURMIS, V., L.C. MERRIAM, JR., M. GRAFSTROM, AND J. KIRWAN

- 1978- "Primary Plant Communities in Voyageurs National Park." 3
- 1980 reports. Prepared for the National Park Service by University of Minnesota, St. Paul, MN.

LIME, D.W.

- 1975 "Sources of Congestion and Visitor Dissatisfaction in the Boundary Waters Canoe Area." Proceedings, 1975 Institute on the Boundary Waters Canoe Area, pp. 68-82.

MANNING, R.E.

- 1985 "Crowding Norms in Backcountry Settings: A Review and Synthesis." Journal of Leisure Research 17(2):75-89.

McCOOL, STEPHEN F.

- 1978 "Snowmobiles, Animals, and Man: Interaction and Management Issues." Transactions of the 43rd North American Wildlife and Natural Resource Conference 43:140-48.

MECH, L. DAVID

- 1966 The Wolves of Isle Royale. Washington: U.S. Government Printing Office.
- 1970 The Wolf, The Ecology and Behavior of an Endangered Species. Minneapolis: University of Minnesota Press.



- 1973 "Wolf Numbers in the Superior National Forest of Minnesota." Prepared for the Forest Service, North Central Forest Experiment Station, St. Paul, MN.
- MECH, L.D., AND P.D. KARNIS
- 1978 "The Role of the Wolf in a Deer Decline in the Superior National Forest." Prepared for the Forest Service, North Central Forest Experiment Station, St. Paul, MN.
- MECH, L. DAVID, SAZAR M. GOYAL, CHRISSIE N. BOTA, AND ULYSSES S. SEAL
- 1986 "Canine Parvovirus Infection in Wolves (Canis lupus) from Minnesota." Journal of Wildlife Diseases 22:104-06.
- MECH, L.D., S.H. FRITTS, G.L. RADDE, AND W.J. PAUL
- 1987 "Wolf Distribution in Minnesota Relative to Road Density." Wildlife Society Bulletin.
- MERRIAM, L.C., JR., AND VILIS KURMIS
- 1981 Voyageurs National Park - Research Studies of a New Park, Its Development, Potential Visitors, and Plant Communities, 1973-1980. College of Forestry, University of Minnesota.
- MINNESOTA DEPARTMENT OF CONSERVATION
- 1955 A Field Study of the Timber Wolf (Canis lupus) on the Superior National Forest, Minnesota, by M.H. Stenlund. Technical Bulletin No. 4. St. Paul, MN.
- MINNESOTA DEPARTMENT OF NATURAL RESOURCES
- 1979a State Comprehensive Outdoor Recreation Area Plan: Minnesota Cross Country Skiers. Report 2321. Office of Planning, St. Paul.
- 1979b State Comprehensive Outdoor Recreation Area Plan: Minnesota Snowmobile Report. Report 2322. Office of Planning, St. Paul.
- 1980 Minnesota Timber Wolf Management Plan. St. Paul.
- 1983 A Master Plan for the Tower to International Falls Trail. Trails and Waterways Unit, St. Paul.
- 1984 The Minnesota DNR Trail Plan: A Discovery Process. St. Paul.
- 1985a Minnesota State Comprehensive Outdoor Recreation Plan. Draft. Office of Planning, St. Paul.
- 1985b Recreation Development Opportunities, Edge of Wilderness Area. Office of Planning, St. Paul.
- MINNESOTA ENVIRONMENTAL QUALITY BOARD
- 1979 "Local Economic Analysis: A Case Study of Ely, MN," by Mark Donaldson and Richard Lichty. Regional Copper-Nickel Study.

MOEN, AARON N.

1976 "Energy Conservation by White-tailed Deer in the Winter." Ecology 57:192-98.

1978 "Seasonal Changes in Heart Rates, Activity, Metabolism, and Forage Intake of White-tailed Deer." Journal of Wildlife Management 42:715-38.

MOEN, AARON N., SUSAN WHITTEMORE, AND BONNIE BUXTON

1982 "Effects of Disturbance by Snowmobiles on Heart Rate of Captive White-tailed Deer." New York Fish and Game Journal vol. 29, no. 2 (July).

MONSON, PAUL H.

1986 "The Flora of Voyageurs National Park." Department of Biology and Olga Lakela Herbarium, University of Minnesota, Duluth.

NATIONAL PARK SERVICE, U.S. DEPARTMENT OF THE INTERIOR

1977 "Environmental Assessment - Use of Snowmobiles, Voyageurs National Park, MN." On file at Voyageurs National Park.

1979 Final Environmental Statement, Master Plan, Voyageurs National Park. Denver Service Center.

1980a Master Plan, Voyageurs National Park. Denver Service Center.

1980b Draft Environmental Impact Statement, Wilderness Recommendation, Voyageurs National Park. Denver Service Center.

1980c Wilderness Recommendation, Voyageurs National Park. Draft. Denver Service Center.

1981 Natural Resource Management Plan and Environmental Assessment, Voyageurs National Park. On file at the park.

1983 "Visitor Use - Carrying Capacity Relationships in Voyageurs National Park, 1983." On file at the park.

1984 "Visitor Use - Carrying Capacity Relationships in Voyageurs National Park, 1982-1984." On file at the park.

1986a Human/Bear Management Plan, Voyageurs National Park. On file at the park.

1986b Lakecountry and Backcountry Site Management Plan and Environmental Assessment, Voyageurs National Park. On file at the park.

1987a Draft Cultural Resources Management Plan, Voyageurs National Park. On file at the park.

- 1987b Draft Natural Resource Management Plan and Environmental Assessment, Voyageurs National Park. On file at the park.
- 1987c Wildland Fire Management Plan, Voyageurs National Park. On file at the park.
- 1988 Lakecountry and Backcountry Site Management Plan, Voyageurs National Park. On file at the park.
- NELSON, MICHAEL E., AND L. DAVID MECH  
 1986 "Relationship between Snow Depth and Gray Wolf Predation on White-tailed Deer." Journal of Wildlife Management 50:471-74.
- NEWMAN, PETER W., AND H. GRAY MERRIAM  
 1972 "Ecological Effects of Snowmobiles." Canadian Field Naturalist 86:207-12.
- NORTHERN STATES BALD EAGLE RECOVERY TEAM  
 1983 Northern States Bald Eagle Recovery Plan.
- OHMANN, L.F., AND R.R. REAM  
 1971 "Wilderness Ecology: Virgin Plant Communities of the Boundary Waters Canoe Area." Prepared for the Forest Service. North Central Experiment Station, St. Paul, MN.
- PETERSON, ROLF O.  
 1976 "Wolf Survey in Voyageurs National Park." Prepared for the National Park Service. Michigan Technological University, Houghton, MI.
- 1977 "Management Implications of Wolf-Moose Research, Isle Royale National Park, Michigan." Prepared for the National Park Service. Michigan Technological University, Houghton, MI.
- 1985 "Wolf-Moose Interaction in Isle Royale National Park." Prepared for the National Park Service. Michigan Technological University, Houghton, MI.
- POTZGER, J.E.  
 1953 "History of Forests in the Quetico-Superior Country from Fossil Pollen Studies." Journal of Forestry 51:560-65.
- RICHENS, VOIT B., AND GERALD R. LAVIGNE  
 1978 "Response of White-tailed Deer to Snowmobiles and Snowmobile Trails in Maine." The Canadian Field-Naturalist 92:334-45.
- SCHULTZ, RICHARD D., AND JAMES A. BAILY  
 1978 "Responses of National Park Elk to Human Activity." Journal of Wildlife Management 42:91-100.

SWAIN, A.M.

- 1973 "A History of Fire and Vegetation in Northeastern Minnesota as Recorded in Lake Sediments." Journal of Quaternary Research 3:383-96.
- 1981 "Vegetation and Fire History at Voyageurs National Park." Prepared for the National Park Service, Midwest Archeological Center, Lincoln, NE.

THIEL, RICHARD P.

- 1985 "Relationship between Road Densities and Wolf Habitat Suitability in Wisconsin." American Midland Naturalist 113:404-7.

UNIVERSITY OF MINNESOTA

- 1974a The Ecology of Upland Forest Communities and Implications for Management in Itasca State Park, Minnesota, by H.L. Hansen, V. Kurmis, and D.D. Ness. Technical Bulletin 298, Forestry Series 16. Agricultural Experiment Station, MI.
- 1974b The Ecology of the Isle Royale Moose with Special Reference to the Habitat, by L.W. Krefting. Technical Bulletin 297, Forestry Series 15. Agricultural Experiment Station, MI.
- 1980 "A Needs Assessment of Tourism Firms Serving the Boundary Waters Canoe Area Wilderness Vicinity." Agricultural Experiment Station.
- 1981 "Managing the Environment for Diverse Recreation: Cross-Country Skiing in Minnesota," by G.E. Ballman et al. Station Bulletin 554-1981. Agricultural Experiment Station.
- 1983 Demand and Response: The Case of Snowmobiling in Minnesota. T.B. Knopp and W. Wiland, Station Bulletin 551-1983. Agricultural Experiment Station.

VAN BALLEMBERGHE, VICTOR, ALBERT W. ERICKSON, AND DAVID BYMAN

- 1975 "Ecology of the Timber Wolf in Northeastern Minnesota." Wildlife Monographs April, no. 43.



## PLANNING TEAM AND CONSULTANTS

### PLANNING TEAM

#### Denver Service Center

John Austin, Economist  
William Conrod, Natural Resource Specialist  
Allen Hagood, Project Manager  
David Kenney, Natural Resource Specialist  
Greg Sorensen, Writer/Editor

#### Midwest Regional Office

David Given, Planning Coordinator

#### Voyageurs National Park

Russell Berry, Jr., Superintendent  
Jim Benedict, Resource Management Specialist

### CONSULTANTS

Advisory Council on Historic Preservation  
Minnesota State Historic Preservation Office  
NPS Midwest Archeological Center  
Voyageurs National Park--  
Joe Cayou, Operations Specialist  
Glen Cole, Supervisory Research Biologist (retired)  
Leigh Evans, Roads and Trails Foreman  
Richard Frost, Assistant Superintendent  
William Gardiner, Chief Interpreter  
Mary Graves, Cultural Resource Specialist  
Lee Grim, Resource Management Biologist  
Peter Gogan, Terrestrial Research Biologist  
Larry Kallemeyn, Aquatic Research Biologist  
Dennis Lagergren, Axeman/Trails  
Raoul Lufberry, Facility Manager  
Steve Martin, Chief Ranger  
Roger Moder, District Ranger/Trail Plan Coordinator

As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Publication services were provided by the editorial and graphics staffs of the Denver Service Center. NPS D-57 November 1988



3 1604 004 717 858

## DATE DUE

[illegible]

